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Lemon Picking and the Ventura County Tree Production Incentive Wage System

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Lemon Picking and the Ventura County Tree Production Incentive Wage System[1]

THIS BULLETIN

*describes lemon picking practices and standards in Ventura County and their development over the past twenty years

*discusses the variations of picking rates due to orchard, seasons, differences in pickers and management practices and their effect on costs and earnings

*explains the use and effectiveness of the tree production incentive wage system as a device to stabilize earnings

*examines the impact a minimum wage would have upon picker wages and practices

*suggests an intended level of earning as an alternative to the minimum wage concept

The bulletin is aimed specifically at employers of lemon pickers but many of its findings should be of value to other users of farm labor and to those outside agriculture who are faced with basically similar labor conditions.

ACKNOWLEDGMENT

We wish to express our appreciation to the managements, directors, and members of the lemon packing houses in Ventura County, for more than twenty years of cooperation and friendship. We also wish to thank Mr. H. Najima, assistant specialist, Agricultural Experiment Station, University of California, Los Angeles, for his invaluable contribution in gathering and analyzing all 1954–55 data used in this report.

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LEMON PICKING IN VENTURA COUNTY

The average cost of picking lemons in California can be calculated for 1961–62 at 45 cents per 50-pound field box of fruit (California Citrus League, 1963A). A similar calculation for the same year indicates that all labor and material costs for lemon production on the tree averaged 85 cents per field box (California Citrus League, 1963B). The 45 cents picking cost, being a cash charge direct to growers, clearly is one of their most important expenses. Picking efficiency must receive, therefore, close attention.

Ventura County in 1962 had about 21,245 acres of lemons, some 46 per cent of the state's total (California Crop and Livestock Reporting Service, 1963) but because of higher yields was producing about half of the state's lemon crop. Ventura County has the world's greatest concentration of lemon production so the area study is particularly significant as to industry picking costs.

There are 737 lemon growers in Ventura County.[2] The picking is done by 13 large packing-house organizations (figure 1), most of them handling more than 1,000 acres of lemons each. Four of these 13 operate two complete lemon packing houses each. (Only 16 houses are shown in figure 1 because one organization has two complete houses only a block apart under one name.)

Six of the packing-house organizations are cooperatives. Four others are each owned by a farming organization doing its own picking and packing. (Two of these also operate large orange operations, both growing and packing, and one also picks and packs for other growers). The remaining three lemon packing-house organizations are privately owned, specialized packing-house organizations, in each case picking and packing for a number of growers. (Two of these three, however, are owned by people having other large farming interests as well).

Because picking and packing fruit requires highly specialized management and a large investment, many growers (even those growing up to a thousand acres of lemons) turn their picking operations over

[2] Correspondence with office of Agricultural Commissioner, Ventura County Dept. of Agric., Santa Paula, August 1, 1963.

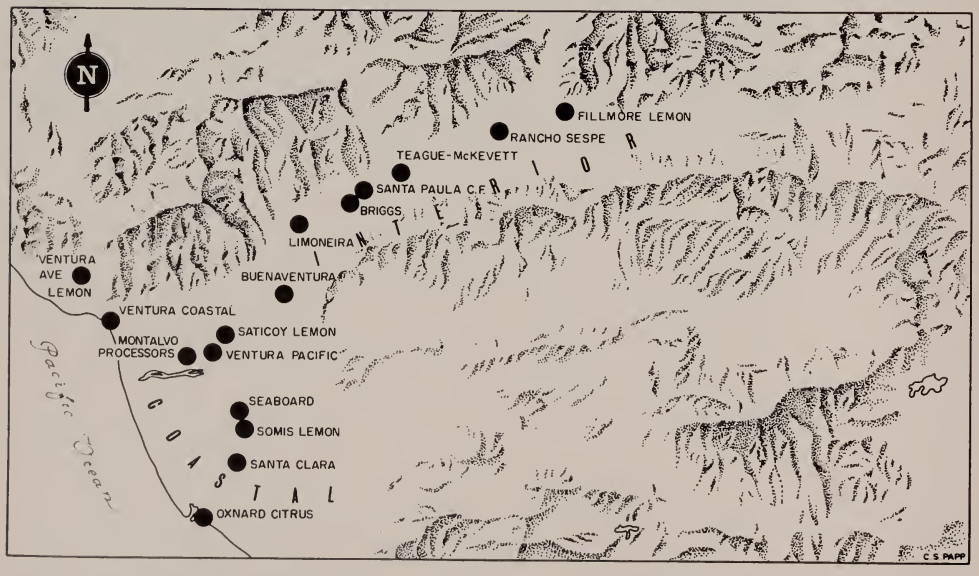


Fig. 1. Location of lemon packing houses in the coastal and interior area of Ventura County. Three houses now are joined with others, making it 13 packing house organizations in all.

to the packing houses. Because orchard operations, such as irrigating and spraying, must be synchronized with picking, the packing-house managers keep growers informed about policies and practices and try to obtain their assent. The growers in a cooperative have final control through the board of directors. Most growers, however, leave the picking problems almost entirely in the hands of the packing-house management through their board of directors.

Since World War II, most of the picking has been done by Mexicans imported under a treaty contract arrangement between the United States and Mexico. The Mexican braceros are brought into the country under the supervision of the Ventura County Citrus Growers Committee which assigns them to the various organizations that do the picking.

There also exist in the county eight grower associations which are directly responsible for the pickers and their immediate supervisor. Each of these organigations is incorporated, directed by a board of directors made up of growers, and handles both orange and lemon operations. These grower associations require all their members to become individual members of the Ventura County Citrus Growers Committee to be their procuring agent for harvest labor regardless of types or original source. The grower associations operate the labor camps and personnel hauling equipment, hire the picking foremen, and pay all bills directly related to picking. The picking policy, however, is established by the packing house.

THE TREE PRODUCTION INCENTIVE WAGE SYSTEM

Since World War II, Ventura County has been using a unique wage system for paying lemon pickers. The next two sections describe the specific system now in use, its concepts and history.

The system is usually called the "tree production incentive wage system." Since the system is also applied to crops other than trees and even to nonagricultural enterprises, the name has serious faults. A phrase like "classified task incentive wage system" might be better. However, the tree production name is well established in agriculture and is used in this report.

The wage rates for lemon pickers in Ventura County are given in table 1. A different rate structure is shown for each of the four different tree classes, arranged by tree size. Each class of trees is further divided into several fruit-size classes (expressed by number of fruit per box) and yield-per-tree classes (expressed by boxes and fractions of boxes per tree).

These various rates are necessary because different orchards pick at very different rates of pick in boxes per hour. Some picking is more than three times as fast as other picking. These differences are inevitable. No picker should be asked to pick in a slow-picking orchard without a higher rate of pay per box than he would accept in an average orchard. A variation is necessary in the rate of pay from orchard pick to orchard pick if equity is to be maintained for pickers.

The Tree Production System is Simple

It appears complicated only because it covers all kinds of picking. But we have no choice, fruit must be picked in all kinds of situations whether the picking is fast or slow.

Setting the tree class: A sample of trees in every orchard block is measured from ground to highest fruit to be picked. If ground is sloped or terraced, the lowest ground side for a tree is used for measuring height. The packing house has a record of this height. Each tree class in the table has its own set of box rates.

Yields: The box rate varies with different yields of boxes per tree. The lower

Table 1. Rates of pay in cents per box for lemon picking, by tree classes, by yields, and by fruit size, Ventura County, January 23, 1964.

Yield	Class I†			Class II			Class III			Class IV		
	Fruit size (number per box)											
	Under 240	240–300	Over 300	Under 240	240–300	Over 300	Under 240	240–300	Over 300	Under 240	240–300	Over 300
*bxs/tree**	*cents*											
0–¼	47	56	70	57	64	75‡	66	72	79	78	86	95
¼–½	41	46	53	48	54	59	55	60	66	67	73	81‡
½–¾	36	40‡	45	42	46‡	51	47	51‡	56	58	63‡	70
¾–1	33	37	41	38	42	45	42	46	50	52	56	62
1–1½	31	33	36	35	38	41	38	41	44‡	47	51	54
1½–2	29	31	33‡	32	35	37	34	37	41	43	46	50
2–3				30	32	35	31	34	38	38	42	46‡
3 +							28	32	36	35	39	43

* Field box capacity: 2,926 cubic inches.
† Tree classification:
Class I — Picked without a ladder.
Class II — Ladder-picked trees less than 9½ feet tall.
Class III — Ladder-picked trees 9½ to 12 feet tall.
Class IV — Ladder-picked trees over 12 feet tall.
‡ Discussed in text.

the yield, the higher the box rate. In table 1, the first column on the left shows the different yields used. The box rates in the second column vary from 29 cents per box to 47 cents per box, going higher with lower yields; the box rates in the last column on the right vary from 43 cents to 95 cents.

Fruit size: Large fruit fills a box faster than small fruit; small fruit requires a higher box rate. Fruit is sized according to fruit count per box, under 240, 240 to 300, and over 300. Under each tree class there are three columns of figures, one for each fruit count. As an example, three of these figures are underlined in the class III columns and in the yield of 1 to 1½ boxes per tree. Notice the box rate of each fruit count: 38 cents for under 240, 41 cents for 240 to 300, and 44 cents for over 300. To further emphasize this fruit size relationship, several examples are underlined. Each set of three figures has similar differences: smaller fruit (larger fruit count) pays a higher box rate.

The effect of tree height: Tall trees are slower picking than small trees, if yields and fruit counts are the same. Notice the figures marked ‡ in the ½ to ¾ boxes per tree yield and each in the 240–300 fruit count. The box rate is higher in the taller trees, going up from 40 cents to 63 cents.

How the rate of pay is set: The tree class is known before the crew goes into the orchard. The yield (boxes per tree) can be known only after the fruit has been picked. The number of boxes picked is divided by the number of trees picked. The fruit count (number per box) can be known only after the fruit has been picked and a sample of boxes have been counted out. IN NO CASE IS ANYONE'S OPINION OR JUDGMENT USED; ONLY FACTUAL DATA ARE USED. For instance: If the picking is in class II trees, if the yield is between 1½ and 2 boxes per tree, and if the fruit count is between 240 and 300 fruit per box, the box rate is 35 cents. Another example: Class III trees; yield of 1 to 1½ boxes per tree; and fruit count of over 300; the box rate is 44 cents. Every box rate used under this system is set by this same method.

Rate of Pick Data

The traditional method used in agriculture for setting up an incentive rate of pay has been to estimate how much a specific worker would earn at a given incentive pay, If, with experience, the earnings are found to be too low or too high, an appropriate adjustment has been made in the pay rate.

In contrast to the traditional method, the method used for Ventura County lemon pickers, as far as possible, has been to measure the rates of work actually achieved by at least a large sample of workers in a large sample of orchards. The classification of orchards and orchard picks, wherever possible, has been the same as that of the rate-of-pay schedule. Workers have been used in large numbers, certainly several hundred, all working under an incentive wage system. An attempt has always been made to exclude inexperienced workers—roughly those of less than two months' experience.

Table 2 is a rate-of-pick schedule from which a rate-of-pay schedule such as table 1 can be constructed. The table on rates of pick shows, in terms of picking rates by the average picker, the influence of tree class, fruit size, and yield. Each classification is defined exactly the same as the comparable classification in table 1 showing the rates of pay.

Intended Level of Earnings

Conversion from the rate-of-pick schedule to the rate-of-pay schedule is made by means of the "intended level of earnings." The intended level of earnings is divided by each successive rate of pick to find the appropriate rate of pay. The intended level-of-earnings relationship between tables 1 and 2 is $1.37 per hour. (We wish to emphasize here, however, that there may be some error in table 2, the rate of pick schedule. The determination of average rates of pick over a composite of conditions such as we are dealing with is most difficult. These difficulties are described in detail later in the bulletin but they relate to differences among workers, orchards, houses, and seasons. As of this date, for instance, management in Ventura County anticipates that experienced men should average about $1.30 an hour rather than the $1.37 which table 2 indicates).

By "level of earnings" we mean the *actual average earnings* per hour of all workers under a given wage system for a season. In setting up the Ventura County

Table 2. Rates of pick in boxes per hour for lemon picking by experienced pickers, by tree classes, by yields, and by fruit size, Ventura County, 1962 data.

Yield	Class I†			Class II			Class III			Class IV		
	Fruit size (number per box)											
	Under 240	240–300	Over 300	Under 240	240–300	Over 300	Under 240	240–300	Over 300	Under 240	240–300	Over 300
*bxs/trees**	*boxes*											
0–¼	2.91	2.45	1.98	2.40	2.16	1.84	2.08	1.91	1.74	1.76	1.60	1.45
¼–½	3.38	2.98	2.60	2.86	2.55	2.32	2.50	2.30	2.10	2.06	1.89	1.70
½–¾	3.79	3.42	3.05	3.29	2.97	2.72	2.95	2.69	2.45	2.37	2.17	1.96
¾–1	4.13	3.76	3.38	3.61	3.30	3.05	3.25	3.00	2.76	2.64	2.42	2.22
1–1½	4.47	4.13	3.79	3.96	3.67	3.38	3.62	3.36	3.10	2.93	2.72	2.53
1½–2	4.81	4.49	4.17	4.29	3.99	3.68	4.02	3.70	3.38	3.24	3.01	2.78
2–3	....	....	....	4.63	4.27	3.90	4.46	4.04	3.63	3.59	3.30	3.00
3 +	....	....	....	....	....	....	4.85	4.37	3.80	3.90	3.55	3.20

* Field box capacity: 2,926 cubic inches.
† Tree classification:
Class I — Picked without a ladder.
Class II — Ladder-picked trees less than 9½ feet tall.
Class III — Ladder-picked trees 9½ to 12 feet tall.
Class IV — Ladder-picked trees over 12 feet tall.

tree production wage system, use is made of an "intended level of earnings" to convert the rate of pick data into a rate-of-pay schedule. The level of earnings is the final realized rate of pay. The intended level of earnings is the original objective. If the rate-of-pick data are accurate, the two levels of earnings, the intended and the achieved, will be the same. The intended level of earnings along with the rate-of-pick data determine what the rate-of-pay schedule will be and thus what the ultimate level of earnings will be. Thus, in setting up a rate-of-pay schedule, data on rate of pick must be in hand and management must decide what its intentions shall be as to the level of earnings.

The rate-of-pick data should be based as much as possible on the measurement of actual work under incentives. It should be a purely objective measurement. The intended level of earnings is somewhat in contrast because it requires more judgment: it brings into the picture a wide range of considerations quite different in character from the rate-of-pick data.

The term, "level of earnings" has a variety of meanings. It can be applied to one day's picking, to a payroll period, or to an entire season or year. It can apply to one man or to one crew, to all the crews in a packing house, or to all the crews in the county. It can apply to earnings under a particular rate or to all the rates in a schedule as they average out. In this bulletin, the term "level of earnings" includes all the pay rates in a schedule, unless otherwise specified. Each pay rate in the schedule gives an earning close to the over-all average. Unless otherwise specified, we assume that all the crews in Ventura County are included.

The intended level of earnings is the focal point of decision as to the earnings of labor. As such, it is relatively stable, quite in contrast to the erratic actions inherent in a single-box rate system. It is not the authors' function to determine what this intended level of earnings should be. Our purpose here is to present the relationship that exists between the intended level of earnings, the rates of pay schedule, and the rates of pick data, and to point out the importance of the function which the intended level of earnings performs.

BASIC CONCEPTS

The whole conceptual system of the tree production incentive wage system differs materially from incentive systems commonly found in agriculture. Most commonly a single incentive rate is used and applied to all situations—or at least an attempt is made to do so. With reference to lemon picking we can say categorically that a single-box rate in a community is grossly inequitable to pickers in poor (slower) picking and is grossly inequitable to growers in good (faster) picking. A picker is seldom willing to accept an average rate in all situations; in poor picking he stays away if he can. If the picker does accept this one rate it means the grower with a poor orchard gets his fruit picked at an average rate of pay only because a grower with a good orchard pays an excessive rate. In such a system the good-orchard pick subsidizes the poor-orchard pick.

The most common variation from a single-rate system is to use multiple rates, each set by successive agreements, day to day and orchard to orchard. If each rate is set before picking starts, it must use guesswork as to picking conditions. The guesses are often wrong. If the rate is too low, the crew may quit unless an adjustment upward is made. If the rate is too high the cost to the grower is excessive but nothing can be done about it except to stop picking. There can be a threat of a work stoppage every day. Without a classification of orchards and of picking conditions, there is no way of knowing what the various packing houses in a community are paying. A specific rate of pay has no meaning except in relation to specific picking conditions. There is misunderstanding and conflict between packing houses. In a time of rising wages such a practice is very apt

to lead to acceleration of the rising rates of pay.

The tree production system is also a multiple rate system but the schedule of rates is set up initially as a composite structure. No series of successive decisions are necessary. As a composite structure or schedule the tree production system is not entirely new. Certain elementary examples have been found in crops such as cotton and sugar beets, both in the United States and in some other countries such as England. But nowhere, to our knowledge, has this system been developed in such elaborate detail as in the Ventura County lemon picking industry. However, the details developed there have general interest and wide applicability. They have long since been applied under a wide variety of circumstances in urban industries and we have every reason to believe a wide application in agriculture is quite practical. To establish this general applicability we propose here to outline what we consider to be the basic concepts of the system.[3]

1. Rate of pick differs from worker to worker. Even if the opportunities of the work are made as equal as possible, capability and effort vary among the workers. This basic concept of the incentive wage system is discussed in detail on pages 19 to 23.

2. Rate of pick differs from orchard to orchard. Differences in picking opportunities depend on yield, tree height, tree variety, topography of the orchard, fruit size, age of trees, and other variables. How these factors influence the rate of pick is discussed on pages 23 to 30.

3. A man can be expected to pick lemons according to his capability only if he is paid on a strong incentive basis, such as a rate which is proportionate to output. Picking fruit is hard, dirty work, often done under unpleasant weather conditions. The worker on his own initiative and on his own standard of proper effort cannot be expected to exert himself as greatly under an hourly rate method as under an incentive pay system.

Workers differ in natural, innate capabilities. Some are stronger than others. Some can work longer without tiring, some are quicker, some have better coordination than others. Some enjoy working hard while others do not.

These innate differences, however, do not fully explain differences in output. Differences in exertion also play a part and require incentive such as pay proportionate to output.

Differences in capability are influenced by training. There are slow ways and fast ways of doing a task, and the worker will be anxious to learn the fast ways if the compulsion of proportionate pay is brought into play at an early stage of his learning period; by so doing, management can influence the worker's development substantially.

Management can do little else to influence the rate of work than to offer pay proportionate to output. The wide dispersion of pickers through an orchard, the wide differences among men in their picking rate, and the differences in the physical factors in the orchard, make it difficult for supervisors to estimate the progress of a picker simply by looking at him; there is no objective basis on which to judge how hard a man is working. Supervision alone will not result in a reasonably full effort of the pickers.

There are, of course, compulsions other than incentive pay. A worker, for instance, who very seriously wants to keep his job may work as fast on hourly as under incentive rates. In fact, he may work harder. But it is difficult to determine when such compulsions operate and how effective they are; there are no objective criteria. This difficulty in recognizing or measuring these other compulsions is, in itself, a prime reason for using incentive pay. An incentive pay system, *if properly set up,* acts as a positive and constant influence toward more work, quite apart from the wishes of management. The worker himself gauges its value. He balances his extra effort against the extra pay. The pay is exactly proportionate to output. Management feels justified in paying a certain amount to get its fruit picked; the workers feel justified in doing the work for this specific pay; this amount, no more and no less is paid and received for this extra effort if a proportionate pay rate is

[3] An extensive literature on the subject exists. See, for example Aitkin, 1960, Baldamus, 1961; and Barnes, 1958.

used. Management is freed from making any decisions as to what is a reasonable effort, yet can operate in confidence that a reasonable effort will be made. Each worker is left free to make his own decision.

The phrase "if properly set up" means that the incentive must be regarded favorably by the worker in every situation—a peculiarly difficult matter in lemon picking. Under the tree production system, if picking is easy and fast in a particular orchard and if, therefore, pay rates are low, the reward for extra effort may appear small on a per-box basis. In contrast, in an orchard that is difficult and slow to pick, the reward may appear much greater on a per-box basis. In both situations, however, if the incentive pay system is properly set up, the reward for extra effort in extra returns per hour will be the same. The picker, can exert effort or not as he wishes, and will receive an extra reward which is stable for each individual when looked at from an hourly basis.

A significant feature of a good inventive pay system is the acceptance, by both fast and slow workers, of their differences in earnings. The extra returns are the reward of greater capability and effort. There is rarely any objection to it. The worker can decide, for himself, if he want to work hard or not.

4. To earn wages in proportion to one's output not only is equitable but socially desirable. If a fast picker were paid less than a proportionate increase in earnings, compared to a slow picker, he would not be paid what he has earned; and the employer would get some extra work done (that part due to the worker's extra capability and effort) at less than full cost. On the other hand, if the same wage is paid to all, and the fast man is not paid proportionately more, the slower picker is paid for his work at more than his full contribution. Any such underpayment or overpayment of the worker is inequitable for worker and employer alike. The fast worker who receives extra pay for his extra work should have no feeling of unjustified payment for receiving it and the employer should have no feeling of unethical discrimination among his workers for paying it.

5. Every picker is entitled to the same earnings per hour in successive orchards and under successive picking conditions, regardless of the physical factors in the orchards, assuming he makes a normal effort. Workers are increasingly insistent on that point.

In paying fruit pickers, fluctuations in earnings are often treated casually because it is argued that low earnings in one situation will be balanced by high earnings in another; that equity will be achieved automatically.

While it is true that a reasonable equity to pickers will be achieved in time, the balance, as a practical matter, must occur mostly within a payroll period. Workers become impatient if it takes more than a payroll period to balance out. Crews quickly become discouraged because of low earnings.

To predict earnings in future orchards, however, is difficult. It requires an estimate, for instance, of what the yields will be and of how these yields will effect the rate of pick. Estimating yields is far more complex than the tree production wage system which depends on production data gathered as the crop is picked.

The time required to achieve any such balance, moreover, can be very long. In Ventura County, for instance, where rates of pick are slow except in the spring and perhaps in the fall, a full year will normally elapse before a complete balancing of earnings will have taken place. Moreover, there are years of high yields and large fruit and years of low yields and small fruit. Earnings inevitably fluctuate from year to year if a single box rate is used all the time. It is not practical to wait such a long time until earnings can be balanced out.

Finally, differences in earning will arise not only from differences in the picker's capability or effort but from picking conditions or opportunities. Such differences in earnings are not easily acceptable by laborers. They will compare earnings, and discontent is certain to result.

6. The grower's cost of picking should be related to the rate of pick to be achieved by the average man exerting a normal effort. Differences in rate of pick among orchards quite properly result in dif-

ferences in cost of picking. On a very large ranch, the differences in earnings among pickers might be disregarded so far as the grower's equity is concerned. But where the cost is charged directly to successive growers, differences among the successive orchards because of differences in the level of earnings can be regarded as inequitable to the growers. If a picker is kept at a low rate of pay in an orchard simply on the argument that his poor earnings there will be compensated for elsewhere, the grower with the poor orchard is being subsidized by the high earnings of his pickers elsewhere. They would not otherwise pick his orchard. Growers who offer good picking opportunities and yet have to pay high earnings per hour to compensate the picker for this other poor picking are not treated fairly.

Each grower should be asked to pay exactly what it really costs to pick his own orchard, measured in time for a given capability and effort. Overhead costs such as that of the cooperative packing-house manager may be charged on a pooling basis, but easily distributed costs, such as the direct costs of picking labor, should be charged on the exact costs involved. This is not only a matter of equity but a wise long-term production policy: high productivity is encouraged, low productivity is discouraged.

In any industry community, then, it seems desirable to maintain a constant level of earnings for any particular capability and effort.

7. Where differences in picking conditions require a different rate of pay per box, these successive rates must be determined by physical measurements or classifications and not be subject to the vagaries of human judgment or the bias of human motives.

The traditional method of payment on an incentive basis in agriculture is for the employer to offer a prospective employee some given rate of pay per unit of work, say boxes picked. The prospective employee may or may not accept the offer. If he does not accept it the employer may either look for some one else to do the work or the two must bargain.

The hiring for each orchard or block can be at a different rate. Each such hiring can be an occasion for controversy between employer and employee. At best, judgments differ as to rates of pick to be expected, and in each case there is a chance to favor oneself. If the employer can have an orchard picked for less, he will do so; if the pickers can obtain higher rates, they will insist upon them. Frequently controversy can be expected where personal judgment enters into the rate of pay in every orchard.

Employers have commonly attempted to set "going rates of pay" for the community. Their object is to keep rates down but they also must attract and satisfy labor.

A single rate per box for all picking in a community acts as a trip mechanism, automatically reset, to bring about discontent and an argument for a change in rates. A poor earning situation, in certain orchards, would serve as justification for a higher rate. The higher earnings in another orchard would support this argument: if one grower pays more per hour, why not others? The adoption of a higher rate for these poor earnings situations, however, would start a spiraling: the use of the single-box rate would raise earnings in good earning situations. This would justify another raise in the poor situations, and so on. It is inevitable that under these circumstances, the single-box rate for all pickings would tend to spiral upward, forcing higher earnings for pickers out of growers.

A downward spiral is just as likely to occur under conditions that favor it. A high level of earnings can hardly be justified if, elsewhere, pickers are available at lower levels of pay. So the single-box rate is reduced. If this rate is also being used in the area of lower level of pay, it will result in further reductions of earnings, and so on.

Where the only organization existing is that of the employers and where earnings fluctuate widely through a succession of orchards, one can assume that the employing organization will make sure that there is always a good proportion of orchards with a low level of earnings. A strong labor union, on the other hand, would use fluctuating earnings or differences in earnings as a prime cause for

insisting on a higher level of pay, by highlighting poor earning situations. Emphasis, then, needs to be given to the trip mechanism inherent in a single-box rate system in a community. Earnings per hour inevitably differ and justification is always at hand for a general wage change.

There are, of course, limits to such a succession of changes. If earnings became too low, pickers would simply fail to show up and an adjustment upward in earnings would have to be made if the growers wanted their fruit picked. If, on the other hand, earnings became too high, growers could refuse to hire and let their crop go unharvested. But reliance on such limits either way is unwise and brings conflict to an industry. They may have to be accepted where there is no good alternative. Fortunately, the tree production incentive wage system eliminates the trip mechanism aspects of a single-box rate wage system.

An example of a wage schedule system that is easily subject to human motives is the so-called "crew average rate of pay" system. The system consists of a schedule of daily crew averages with an accompanying rate of pay for each average, all designed to pay the same earnings per hour. Table 3 presents such a schedule as an example, one actually used by important sectors in the lemon industry.

At the end of the day, the crew average rate of pick is calculated. This rate of pick is found in the first column of the schedule and the rate of pay is found alongside in the second column. This rate of pay in cents per box is used for paying the crew.

Table 3. "Crew average rate of pay" incentive system. Piece rate schedule lists figures for crew average production for an eight hour day.

Piece rate schedule		Average earnings	
Crew average	Rate of pay	Dollars/8 hours	
boxes/8 hours	*cents/box*	*minimum*	*up to*
12–13	70 ¢	$8.40	$9.10
13–14	65	8.45	9.10
14–15	60	8.40	9.00
15–16	56	8.40	8.96
16–17	52½	8.40	8.92
17–18	49½	8.42	8.91
18–19	47	8.46	8.93
19–20	44½	8.46	8.90
20–21	42	8.40	8.82
21–22	40	8.40	8.80
22–23	38½	8.47	8.86
23–24	36½	8.40	8.76
24–25	35	8.40	8.75
25–26	34	8.50	8.84
26–27	32½	8.45	8.78
27–28	31½	8.51	8.82
28–29	30	8.40	8.70
29–30	29	8.41	8.70
30–31	28	8.40	8.68
31–32	27½	8.52	8.80
32–33	26½	8.48	8.74
33–34	25½	8.41	8.67

There are, of course, many part-days; in fact, an exact eight-hour day may be missed frequently. Pickers move during the day from grower to grower and a different rate of pay is figured for each one. One procedure for calculating these part-days is to total both man hours and boxes

The successive orchard picking as it exists in the California citrus industry.

The picker is hired to work in a succession of orchards or blocks. Just what the particular succession will be for a particular picker is probably not known to anyone at the time of the hiring. Which orchards will be picked by which crews may not be decided until the time of the picking. The management may have a general plan for the succession of orchards to be picked but will not commit itself as it may be desirable to change the succession. Fruit in an orchard may be growing in size more rapidly than anticipated or changing in color so that it must be picked and stored quickly. In Ventura County, using braceros, the organization is even more centralized: it is countywide and both individuals and crews are moved from packing house to packing house.

Under these conditions, it is unavoidable that picking opportunity in rate of pick varies. A single-box rate inevitably brings about fluctuations in earnings.

picked, divide the boxes by the man hours, and then multiply by eight. The same method can be used for days longer than eight hours. The schedule can be set up on a one-hour basis, if so wanted. The rest of the accounting process is identical with any multiple rate wage system such as the tree production incentive system. The advantage of the crew average wage system over the tree production incentive wage system is that tree classifications, yields, and fruit sizes need not be determined.

The third column in table 3 shows the minimum earnings for an eight-hour day. With the pay rates used, the minimum average would be $8.40 an eight-hour day, or $1.05 an hour. Commonly, rates of pick are not in even boxes so earnings would be above this minimum but in no case would they equal the amount shown as "up to." That higher earning level would be achieved only if a full extra box of fruit were picked, in which case the next-lower rate of pay would be used.

No matter what the picking situation or the character of the pickers, the average picker will earn $8.40 or a little more in an eight-hour day. The crew knows this; it is made very clear in any description of the system. Also the crew average can not go much above this $8.40 and even that only as a matter of chance. If the crew decides to pick more slowly, their earnings remain the same. Slow men on the crew have a disparaging attitude toward the fast pickers because faster picking on the part of faster men raises the average rate of pick for the crew and thus lowers the box rate to be paid, thus lowering the earnings of the slow men. If everyone picks faster, no one gains anything. If everyone picks slower, no one loses anything.

Crew supervisors have great difficulty in preventing a slowdown. How can they tell how hard someone is working just by looking at him? The men are scattered among the trees, most of them hidden most of the time. The work is somewhat slow-paced even by fast men, and it is impossible to differentiate the degree of effort. A sharp change in rate is noticeable but an experienced crew will change slowly. The crew's only problem in slowing down is to maintain earnings between the fast and slow men on a proportionate basis. The only specific information available to the management is the amount of fruit picked. If it is decreasing, it may be because of picking conditions. Good management, working closely with men who are new, can sometimes make the system work. With large experienced crews the problem appears quite impossible to control. The crew average rate of pay sys-

How the tree production incentive wage system strengthens the position of management.

- Equity is achieved among workers.
- Equity is achieved among growers and cost differences are justified.
- A uniform system is established among competing packing houses throughout the industry.
- Public relations can be improved. The public is giving increasingly more attention to the relationship beaween labor and management in agriculture. Fluctuations in earnings are subject to serious question. Incentive-wage ideas are widely criticized. This criticism will grow if earnings fluctuate widely and if individual motives and judgment are allowed to influence earnings. Properly set up, the tree production system will prevent most wide fluctuations in earnings. The system depends on production data. The erratic influence of human judgment and motives can be eliminated because day-to-day decisions play no part in operations. The objective classification of tasks and the determination of work rates along with the achievement of a generally accepted level of earnings can win for fruit picking a position of respect and pride, something that now is sadly lacking.

tem has been common throughout the industry for many years. It has not been satisfactory in the long run because it is subject to manipulation by human motives.

8. *A rate system tied to physical factors in the orchard which can be measured objectively makes possible the establishment of an equitable uniformity in earnings over an entire industry.* The same type of equity the incentive wage system establishes among growers of a packing house organization is also established among packing house organizations. Equity among growers in costs is achieved industry-wide. This equity and uniformity in earnings extends over the entire season.

9. *In essence, the rate-of-pay table constitutes a contract covering all the picking in an area during the entire season.* As a contract system it is easily enforced. Each packing house can turn in to a central office a report for each payroll period showing the average level of earnings received by the crew or crews. As shown in the discussion on Earnings Stabilization (pages 30–32), there is a fluctuation in these earnings but the investigator can quite easily recognize when rates of pay are markedly out of line. Consequently a general control is possible with very little work. If a detailed report is needed, all the pertinent information is factual; opinions and judgments are not involved; a conclusion as to whether or not the contract is being adhered to can be explicit.

• the boss (crew foreman, field superintendent, or manager) cannot change or set the rate as he wishes: The rate is set by the table. A picker can check whether he has been paid the box rate shown in the table. He finds the tree class, yield, and fruit count and thus finds the box rate.

• the picker always knows ahead of time what he will be paid: There is a specific prior agreement as to the box rate in all prospective picking situations. The only unknowns are the actual yield and the actual fruit count. They are measured as the fruit is picked. They are matters of fact, not subject to opinion or bias. The picker need never be concerned about his rate of pay.

• the grower can always determine if he has been charged the proper rate. He finds the tree class, yield, and fruit count and thus finds the box rate.

HISTORY OF THE TREE PRODUCTION INCENTIVE WAGE SYSTEM

Some kind of incentive wage system has been in use in Ventura County lemon picking at least since the early 1930's. Throughout the thirties and into the forties a combination rate was paid of 28 cents an hour plus an additional amount per box. Initially the box rate was as low as 3 cents but by the forties it had risen to 14 cents. By 1942 the system had become well established. The incentive rate was regarded as necessary to obtain a reasonable effort from workers. The hour rate was fixed at 28 cents for two reasons.

Earnings per hour on the single incentive rate fluctuated widely between orchards and from month to month. Figure 2 presents a typical sequence. Almost all yields were low from August through January, and crew average rates of pick remained below two boxes per hour. A rate of pick of two boxes per hour brought 28 cents to the picker from his incentive rate of pay. A slower picker with a rate of one and one-half boxes per hour received 21 cents from his incentive rate. In both cases, the pickers also received an hourly rate of 28 cents. As the season progressed, the yields increased to two boxes per tree, three, and even four, and crew average rates of pick rose to peaks of more than four boxes an hour. Incentive earnings per hour rose accordingly. During the rest of the season both yields and rates of pick gradually receded to the November level. In some houses there was commonly a small peak of yields and of rates of pick in the fall (see October, figure 2). Because of these fluctuations and other varying

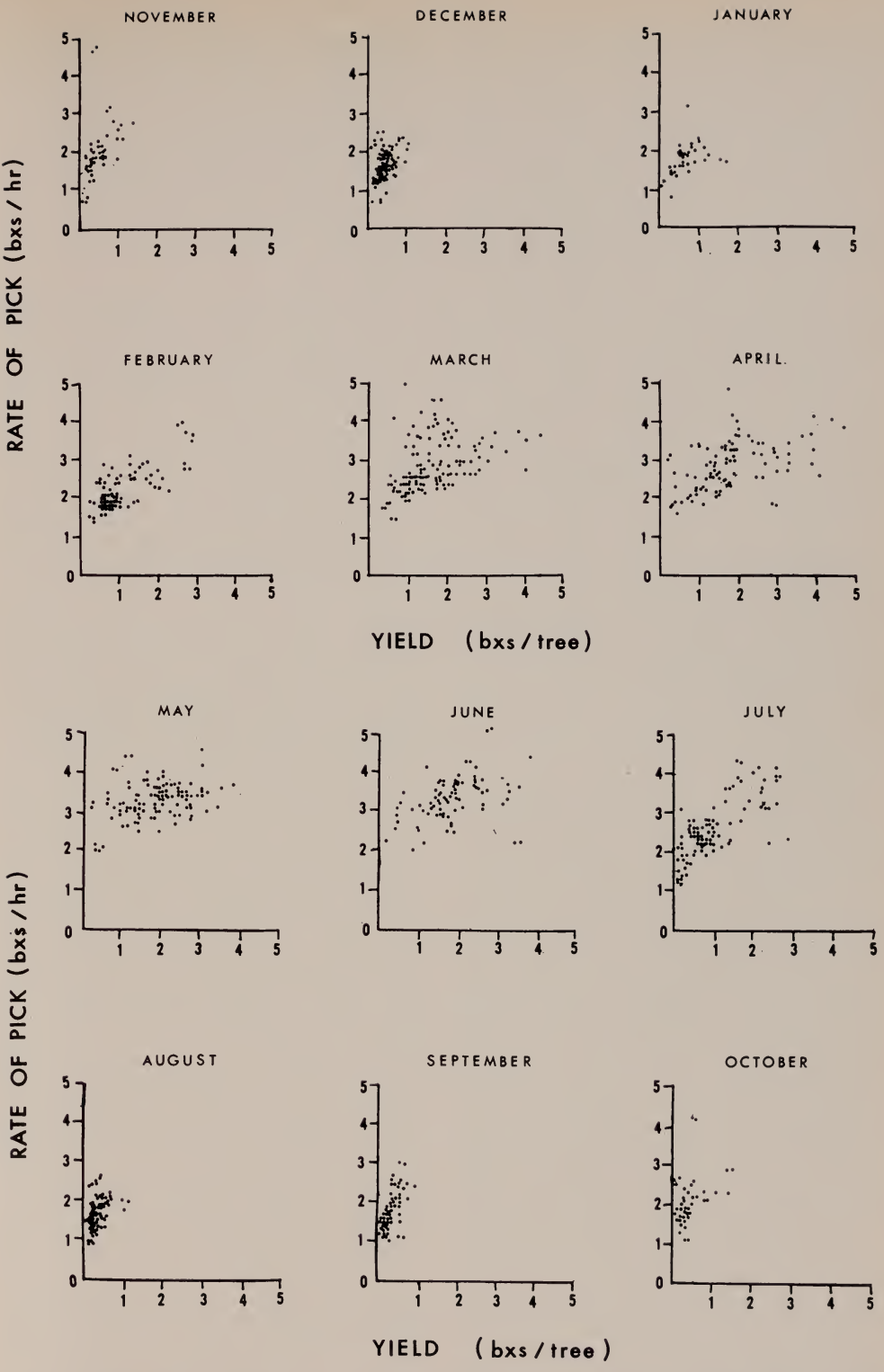


Fig. 2. Individual crew orchard picks, by yield and by rate of pick, in successive months November 1954 to October 1955, House I. All picks four hours or longer.

circumstances, the quantity of fruit to be picked in an hour by an average picker varied widely, from less than two boxes an hour to more than five. The 28 cents an hour served as a "cushion" to smooth out these fluctuations to some degree.

The second reason for paying 28 cents an hour was the custom of paying "wet time"—the time when a crew had been taken to the orchard but picking was delayed because the trees were wet from fog or rain. This situation was quite common, and in fairness to workers the custom had developed of paying the hourly rate for their time. The time before picking started was recorded and named wet time. Picking costs have almost always been charged directly to the grower. Charging wet time directly to the grower and making both rates 28 cents an hour eliminated the need to separate the wet-time rate and the hourly picking rate. It was done by several houses. Other houses, however, treated wet time as an overhead cost, chargeable to the entire association. These houses had to keep a separate time record for the wet time. The hourly rates for wet time and for picking could then be different but it was easier to avoid mistakes if they were the same.

The problem of fluctuating earnings for pickers was not unique in Ventura County but it had aspects which made it more specific than in other areas. The general nature of the fluctuations shown in figure 2 was accurate throughout the county except that the timing varied. The crop in the interior was earlier than on the coast; pickers in the interior would have good picking while picking was still slow on the coast. Later in the year the situation would be reversed, with a large volume of heavy yield picks being harvested on the coast while the interior had only low-yield picks. Variations occurred, sometimes seemingly, by chance. One orchard would have a high rate of pick, the other one a low rate.

All packing houses in the county were using the same rate of pay per box. The local pickers were resident in the county, knew the various associations and their orchards, and knew where picking was good and where they could earn the most money. They moved about freely. Associations with good picking had an excess of pickers; those with poor picking would have difficulty in getting their work done. Twice each year with the ebb and flow of the seasonal crop harvest, there was an outbreak of discontent. Pickers moved because of better earnings elsewhere and because of rumors of good picking. Packing houses could not keep their crews together. Both pickers and management were dissatisfied.

One modification attempted was to raise the box rate at the start of light picking and to change downward at the start of good picking. This system reduced fluctuations but had several serious faults. It was difficult to reach agreement on when to change rates and how much to change. When box rates were raised, the growers objected. When box rates were lowered, the pickers objected. At any one time only one rate was in use and inevitably earnings varied widely from orchard to orchard.

What made the situation particularly critical in 1942 and 1943 was in part due to labor-management conflicts. A serious strike of pickers had occurred in the Spring of 1941. After the strike, which failed to obtain recognition for the union, the old pickers, largely Mexicans living in local towns, were discontented and many left for other work. Packing-house management was also dissatisfied and was looking for other pickers. The inflow of people from the Middle West provided a fair supply but these people looked for better jobs and most of them soon passed on to other opportunities. Also because of the war new jobs were opening up, and wages were rising.

In this situation, the erratic earnings were particularly detrimental. Some associations found it extremely difficult to get their fruit picked. Several houses started to guarantee 65 cents an hour early in 1944. Men would then stay on the job but the incentive pay rates then had little or no effect and the rate of pick soon fell off. Costs rose sharply.

University studies of the problem got underway in 1942 but not until 1944 were there any important developments. In the Spring of that year the county-wide organization of citrus packing houses now known as the Ventura County Citrus

Table 4. Rates of pick in boxes per hour for lemon picking by experienced pickers, by tree classes, by yields, by fruit size, and by area, Ventura County, April 10, 1947.

Yield	Small* trees	Medium† trees	Large‡ trees	Very large§ trees	Normal¶ trees
bxs/tree	*boxes per hour*				
	COASTAL				
0–¼	2.57	1.95	1.79	1.28	1.91
¼–½	3.13	2.33	2.14	1.58	2.29
½–¾	3.63	2.72	2.50	1.90	2.67
¾–1	4.02	3.05	2.80	2.18	2.99
1–1½	4.49	3.43	3.15	2.51	3.37
1½–2	4.98	3.78	3.47	2.84	3.71
2–3	....	4.11	3.77	3.18	4.03
3 +	....	4.38	4.02	3.60	4.30
	INTERIOR				
0–¼	2.33	1.51	1.39	1.16	1.48
¼–½	2.77	1.82	1.68	1.45	1.79
½–¾	3.15	2.14	1.97	1.74	2.10
¾–1	3.43	2.42	2.22	2.00	2.37
1–1½	3.78	2.75	2.53	2.27	2.70
1½–2	4.13	3.09	2.84	2.51	3.03
2–3	....	3.34	3.07	2.74	3.28
3 +	....	3.47	3.18	2.90	3.40

* All trees less than 9½ feet tall.
† Eurekas 9½ to 12 feet tall.
‡ Eurekas 12 to 15 feet tall and Lisbons 9½ to 12 feet tall.
§ Eurekas over 15 feet tall and Lisbons over 12 feet tall.
¶ 1. Substitute for medium and large classes, or, 2. Substitute for all other classes. (Usage varies where class exists.)

Growers Committee set up a special subcommittee to encourage research on the problem. That fall a report was presented and in November an experimental tree production wage incentive system was introduced.

A fortunate feature in Ventura County was that for many years back a uniform and quite accurate hourly record of picking had been maintained by all lemon packing houses. This practice grew out of the practice of paying all pickers a fixed amount per hour which we have called a cushion. Wet time also encouraged it. These hourly records made possible studies of the rate of pick in various picking situations; and also it allowed a check as to how well the wage system was working out in terms of earnings per hour. Without this hourly record it would not be possible to have any accurate or provable idea of the earning situation. This is the reason why comparable studies are not possible in many areas.

The initial tree production incentive wage system adopted in 1944 provided for an adjustment for yield only; there was no tree size adjustment. But pickers quickly discovered that they could obtain very high earnings per hour when picking small, young trees. Such picking did not last long but the fruit was big and easy to reach and the earnings were such that pickers would literally run from tree to tree. We called it "runaway picking." A schedule of smaller rates of pay per box was called for. At the same time it was found that large trees, particularly large Lisbons with their thorns and heavy foliation, slowed the rate of pick. Here a schedule was called for with higher rates of pay. Many of these adjustments had been anticipated in theory but experience was required before management recognized the need for change and before the rates of work could be established. Within a year, however, all associations had accepted the system. The intended level of earnings set up in 1944 was 75 cents an hour. The actual level of earnings achieved, county

wide throughout 1945, was within about 2 cents of this objective.

During the next three years various modifications and adjustments were made. The record keeping techniques were worked out. In 1947, a careful reappraisal was made of the rates of pick (see table 4). The new rates were adopted as official and until 1963 served as the basis for the wage system. In 1954 a technical change was made. Before that year, the county was divided into two areas with different rates of pay schedules. The interior (see figure 1) with smaller fruit had rates of pay per box somewhat higher than the coastal area. In 1955, the entire county adopted a single rate of pay schedule with a new schedule made, however, for large fruit (less than 250 per box) and for small fruit (more than 300 per box). (See table 5.) The whole schedule was modified to fit the county-wide conditions. Since the same rates of pick data and the same intended level of earnings were used for both the old and the new wage schedules, the actual level of earnings was practically the same as in the earlier system. The advantages gained were that the entire county was now on one rate schedule and that adjustments in the rate of pay were made whenever and wherever larger or smaller fruit were picked. The interior and coastal areas were far from being exclusive in the size of fruit each grew. Also any given orchard could have a different size of fruit in one pick than in another.

Two other significant changes were made during this period. The general level of wages was rising and at various intervals corresponding changes were made in the incentive rates of pay. The cushion was abandoned and the pickers paid only a straight box rate. The schedule of pay used, it was thought, provided enough adjustment among the various picking conditions to eliminate the need for the hourly rate as a cushion. Also it was thought that the use of straight box rates throughout the schedule as the sole payment was a more equitable method of payment as between fast and slow pickers. The wet-time pay was retained and raised to 35 cents an hour.

During the last two years further changes have been made. The continuing rise in wage levels has forced upward the rates of pay. Changes developed in the technique of picking which permitted a faster rate of pick and made necessary a new study of the rates of pick. A new rate of pick schedule is now in use as the basis for the rate of pay schedule. The classification of trees by height has been changed. The tall trees, some over 18 feet, which were commonplace in 1944, were expensive to pick under the tree production wage system. Growers began to cut off their tree tops. This practice became so

Table 5. Rates of pay in cents per box for lemon picking, by tree classes, by yields, and by fruit size, Ventura County, May 17, 1954.

Yield	Small trees†			Medium trees‡			Large trees§		
	Fruit size (number per box)								
	Under 250	250–300	Over 300	Under 250	250–300	Over 300	Under 250	250–300	Over 300
*bxs/tree**									
0–¼	40.9	45.0	49.1	55.0	60.5	66.0	82.0	90.2	98.4
¼–½	33.5	36.8	40.2	45.9	50.5	55.1	66.5	73.1	79.8
½–¾	28.9	31.8	34.7	39.3	43.2	47.2	55.3	60.8	66.4
¾–1	26.1	28.7	31.3	35.1	38.6	42.1	48.2	53.0	57.8
1–1½	23.4	25.7	28.1	31.2	34.3	37.4	41.8	46.0	50.2
1½–2	21.1	23.2	25.3	28.3	31.1	34.0	37.0	40.7	44.4
2–3	....	....	....	26.1	28.7	31.3	33.0	36.3	39.6
3 +	....	....	....	24.4	26.8	29.3	29.2	32.1	35.0

* Field box capacity 2,926 cubic inches.
† Trees less than 9½ feet tall.
‡ Trees 9½ to 12 feet tall.
§ Trees over 12 feet tall.

common that special machines were devised for it. Large trees have disappeared; consequently, the county has eliminated any class of trees more than 15 feet tall. In fact, there are only a few orchards with trees taller than 12 feet.

At the same time the county had come to recognize even more clearly the importance of graduation in pay for tree height and has instituted the use of three tree size classes for trees below 12 feet, instead of the two originally set up. Also an improvement in fruit-size classification has been made with the borderline number per field box for large fruit set at 240 rather than 250 as set in 1954.

These details of the history of the wage system in Ventura County are pertinent because of two unique developments there. First, the succession of picking opportunities in successive orchards have been classified so that in any class a worker under normal effort will experience a minimum of fluctuation in his earnings. Second, fairly elaborate statistical techniques have been used for determining normal rates of work in each class. The importance of these developments will be made clear in this report as it proceeds.

INDIVIDUAL RATES OF PICK

That rates of pick differ from worker to worker is one of the basic concepts of the tree production incentive wage system.

Payment in proportion to output brings out these individual differences. Each worker recognizes that the picking of an additional box of fruit adds proportionately to his income. He therefore tends to exert himself to pick as fast as he can. Capability and effort vary widely, however, as table 6 indicates. This table shows the distribution of workers as to rate of pick in a typical crew. This crew data is presented as internally typical but is not representative as to its general level of work. It is an "example" crew.

These workers were in one crew, all working in one orchard of uniform character, all paid the same box rate, and all supervised by the same crew boss. Everything possible was done to provide them with an equal opportunity. They worked, in line, down successive box roads, each road with three rows of trees on each side. Each worker was given a set of six trees. When he finished his set he went to the head of the line and took the next set; thus the set was his as a matter of chance. Differences in tree sets balanced out quickly by this method of operation. As a rule, these sets of trees are quite uniform.

Despite this equality in opportunity, however, the pickers in this crew varied

Table 6. Distribution of workers in an "example" lemon picking crew by rates of pick (boxes per hour) with standard deviation values derived from M = 2.57 and $\sigma = \pm 0.389$.

Class mid-points	Frequency	Standard deviation values
bxs/hr		*bxs/hr* (σ)
3.375	1	3.35 = $+2\sigma$
3.250		
3.125	2	
3.000	3	2.96 = $+1\sigma$
2.875	3	
2.750	5	
2.625	5	2.57 = M
2.500	4	
2.375	1	
2.250	3	2.18 = -1σ
2.125	2	
2.000	1	
1.875	2	1.79 = -2σ
1.750	1	
		1.40 = -3σ
	33	

Standard deviation

Twice the standard deviation

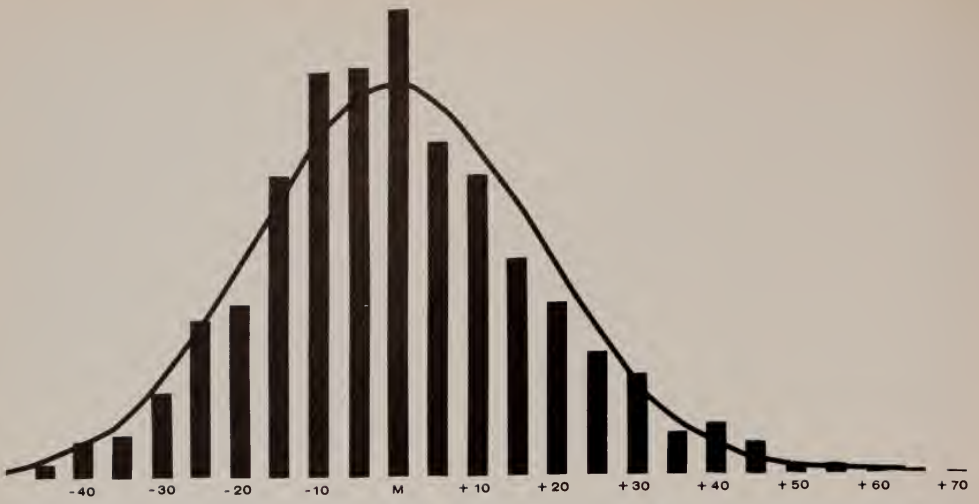


Fig. 3. Average distribution of picker earnings around their daily means for all crew days (January and May 1962 sample data) with curve showing a normal distribution.

widely in rate of pick; the fastest, for instance, worked at nearly twice the rate of the slowest, 3.375 boxes per hour as compared with 1.750 boxes per hour. The standard deviation in rates is ± 0.389 boxes per hour above and below the average of 2.57 boxes per hour; it included six of the rate-of-pick classes. A range twice that of the standard deviation includes all but one frequency at each end. The distribution of rates of pick in this crew was very near the statistical normal. The example shows the normal characteristics of a crew of lemon pickers as to rate of pick.

Further details as to individual rates of pick are shown in figure 3. Here we have a composite picture of the distribution of pickers around their crew mean including pickers in nine crews in May, 1962, and eight in January, 1962, each covering a little under two weeks. The bars show the proportion of the crews found in each earning situation above or below the mean. A normally distributed curve is also shown. The actual distribution was similar to that of a normal distribution except for two aspects. First, there is a falling off in number above the mean and a high accumulation just below it. Apparently many pickers, instead of extending themselves to their normal capability, were content to have earnings just near to the average. Second, a few pickers extend themselves and pick faster than the normal distribution would indicate.

A man will work at greater speed under an incentive system than under an hourly rate system but these differences are diffi-

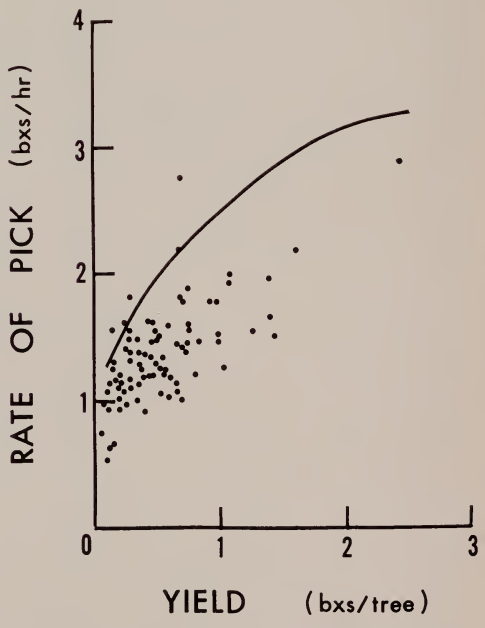


Fig. 4. Individual crew orchard picks (represented by dots), by yield and by rate of pick, workers under guaranteed rates of pay, 1943; and average rates of pick (shown by the curve) by yields, under incentive pay, 1947 data, all similar normal trees, interior area, Ventura County.

cult to measure. An attempt to measure such a difference is shown in figure 4; it compares crew picks under guaranteed pay rates (1943) and those under incentive pay (1947). Each dot represents the situation of a specific crew in a specific orchard pick. All picking shown by these dots was paid for at a guaranteed rate per hour.[4]

The solid curved line represents the average rate of pick in the same type of trees, called "normal" at that time, in the same area, and under the same management. The pickers were under a strong incentive. Notice that picking under the incentive rate was almost always faster than under the guaranteed hourly rate. The increase in rate of pick averaged probably about 40 per cent.

While we cannot assume that workers on an hourly rate never have an incentive to work hard, there was a great contrast in the rate achieved by these workers. On the one side there was a strong incentive. Some incentive was doubtlessly operating on the other side but we do not know what it was except that they all received a uniform hourly pay.

The individual picker, however, has to fit himself into a more complex situation than shown in table 6. He must adjust to conditions in different crews, different orchards, different crops and seasons, and

Table 7. Rates of pick of workers picking lemons by M and σ values, for example crew, for average crew, for average crew with orchard-day deviations, and for average crew with simple overall deviations, May, 1962 data.

Rate of pick scale	Example crew (table 6)	Average crew deviation	Average crew orchard-day deviation	Simple overall deviation
bxs/hr	σ = ±0.389 bxs/hr	σ_1 = ±0.561 bxs/hr	σ_2 = ±0.728 bxs/hr	σ_3 = ±0.835 bxs/hr
6				+3 = 6.00
			+3 = 5.67	
		+3 = 5.18		+2 = 5.16
5			+2 = 4.94	
		+2 = 4.61		
			+1 = 4.21	+1 = 4.32
4		+1 = 4.05		
	+3 = 3.74			
		M = 3.49	M = 3.49	M = 3.49
	+2 = 3.35			
3	+1 = 2.96	−1 = 2.93		
			−1 = 2.76	−1 = 2.65
	M = 2.57	−2 = 2.37		
	−1 = 2.18			
2			−2 = 2.03	
	−2 = 1.79	−3 = 1.81		−2 = 1.82
	−3 = 1.40			
			−3 = 1.30	
1				−3 = 0.98
0				

[4] The rates of work shown here may reflect some incentive rate influence because an incentive rate was paid and would take effect in faster picking, typically in larger yields. It will be noticed that yields shown here are small. Some of the faster picking situations shown could well have reflected a habit of faster picking achieved in the higher yields.

[5] M stands for the arithmetic mean, commonly designated as X.

different houses. To analyze this complex situation, we studied the nine crews in four houses, working for two weeks in May, 1962. The mean value, M,[5] for this May picking in terms of rates of pick was 3.49 boxes per hour. In terms of level of earnings under the tree production wage system, M was 111.4 cents. To describe the distribution of these two sets of values about their respective M, we will use the standard deviation, σ. To describe the impact of different variables, we will use the following subgroups (Waugh, 1952, p. 148):

σ_1: Describes the average daily individual σ obtained by computing the weighted average of the daily σs of all crews in all orchard days. Termed average individual deviation.

σ_m: Describes the weighted daily average σ for all crews. The daily σ for each crew is determined from each crew's over-all M average for the two-week period.

$\sigma_2 : \pm\sqrt{{\sigma_1}^2 + {\sigma_m}^2}$: Describes the average weighted crew reflecting the variations between orchard days as picked by a weighted average crew in a weighted average house. Termed average crew-orchard-day deviation.

$\sigma_3 : \pm\sqrt{\frac{\Sigma(x^2)}{N-1}}$, where x = deviation of each individual crew orchard-day from the overall average of all crew days, from all crews, in all orchard days, in all houses. Termed simple overall deviation.

The values obtained from the May, 1962, data for each of the above measures were as follows:

	Rate of pick (bxs/hr)	Earnings per hour (cts/hr)
M	± 3.49	±111.4
σ_1	± 0.561	+ 17.9
σ_m	± 0.464	± 10.7
σ_2	± 0.728	± 20.8
σ_3	± 0.835	± 22.2

These rate of pick data when distributed by the various deviation definitions and by various σ levels, are shown in table 7. Along with them are shown the same data for the example crew of table 6. (It will be understood that another example crew would quite likely have had different M and σ values.) The extreme $\pm 3\sigma$ values are encountered only rarely in a crew; they are shown to establish an extreme limit to our interest.

The successive deviations are from the specific example crew deviations on one specific day (σ), to the average crew deviations on an average day (σ_1) to this average crew with the additions imposed by orchard day deviations (σ_2), to the simple overall deviations which include different house practices or opportunities (σ_3). The individual crew is not likely to have exactly the same spread in capability and effort as would an average crew. The average crew would certainly encounter both faster and slower picking as it worked through its sequence of orchard or orchard-days. Each day in an orchard has to be treated as an entity by itself and might well be defined as either a day or an orchard but the two terms together are more exact. The simple over-all concept brings into the picture the influence of house differences. These house differences may best be described in terms of practices and standards as discussed in a later section or they may simply be differences in picking situations as between houses.

In summary it may be noted that in the example crew a $+ 2\sigma$ picker picked 3.35 boxes per hour or 1.87 times faster than the -2σ picker at 1.79. With the orchard-day and house variables included, however, picking at the $+ 2\sigma$ level was 5.16 boxes per hour or 2.84 times faster than at the -2σ level or 1.82. The more comprehensive coverage of deviations inevitably increases the range in rates of pick, in this case from 1.87 times faster at the $\pm 2\sigma$ level to 2.84 times faster.

Figure 5 presents information correlating the σ value of crews with their mean values. In the figure, the mean values, M, are ranked horizontally and the σ values vertically. The linear regression line of $y = 0.212 + 0.1\ x$ drawn for the braceros indicates that perhaps 25 per cent of the fluctuation in σ is associated with the fluctuations in M. Such an association cannot be thought of as important.

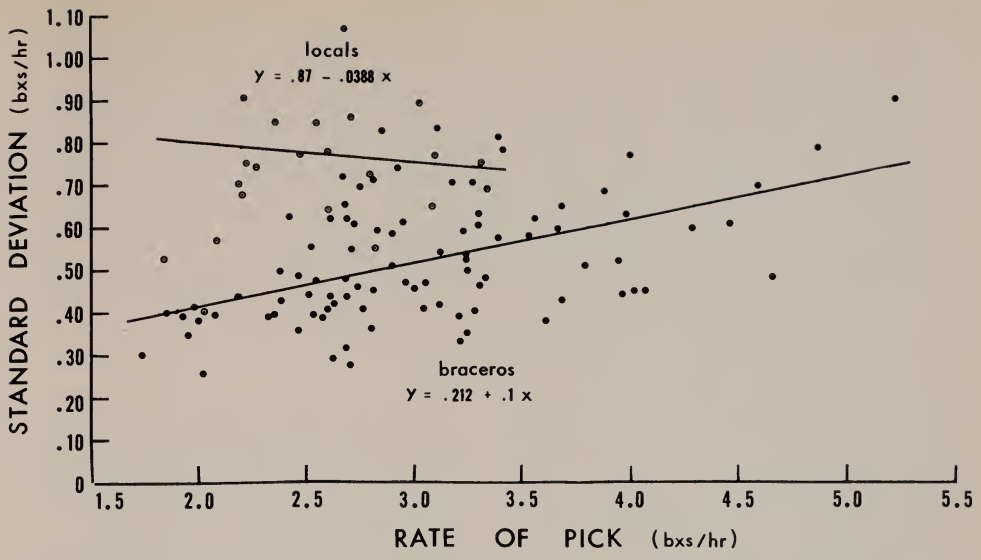


Fig. 5. Individual crew orchard picks, by rate of pick and standard deviation, with net regression relationship for bracero crews (dots) and for local crews (circles), May, 1962 data, Ventura County.

Locals vs. Braceros

Figure 5 also shows the standard deviation for pickers classified as locals. Their σ values are significantly larger than the σ values for braceros. This contrast is a foreboding note in view of the anticipated ending of the contract Mexican program. The larger σ means that the earnings of these locals will be more erratic than those of the Mexican Nationals. Such a condition also means that the stabilization characteristics of the tree production incentive wage system will be even more important. Every possible measure must be taken to develop a proper *esprit de corps* in the crews and every possible refinement adopted in the wage system which will contribute toward stabilized incomes. These locals will require very careful management. With good training, with time to gain experience and a feeling of unity, and with reasonable opportunities in earnings, there is good reason to think, however, that the problem can be worked out.

RATE OF PICK AS INFLUENCED BY ORCHARDS AND ORCHARD PICKS

Another basic concept of the incentive wage system is the differences in picking opportunities presented by successive orchards. Table 2 indicates something of the spread a crew averages: from 1.45 boxes to 4.81 boxes per hour. The wage system has to deal with these differences. Figure 2 presents an elaborate picture of the differences among crew-days in rates of pick. In any given month there is a wide fluctuation.

The May 1962 data, mentioned above,

offered an opportunity to analyze these fluctuations using crews whose individual makeup and experinece can be considered as highly consistent from orchard-day to orchard-day. Eleven crews are included from five houses, working a total of 2,883 man-days. The standard error of the weighted crew average rates of work, each crew's error measured from its own over-all mean, was ± 0.4972. This means that on 32 per cent of the days, the average rate of pick of a crew was one-half box or more per hour greater or less than its over-all average rate of pick. It also means that on nearly 5 per cent of the days, a crew's average rate of pick was one full box or more per hour more or less than on its overall average.

Referring again to the situation in successive months, as shown in figure 2, it is apparent that, if a crew could be followed through a year, the fluctuation in rates of pick would be greater than that shown for one month alone. This ever-present fluctuation in rates of pick constitutes the basic problem with which we must deal in designing a wage system.

Table 2 shows the rate-of-pick data on which the present (1964) rate of pay schedule (table 1) is based. These data in the rate-of-pick table are measurements of the average rate of pick achieved by pickers in each of the orchard situations described. Tree height, yield per tree, and the size of fruit are the factors dealt with directly in this schedule.

Yield

The influence of yield on rate of pick is made clear in figure 6 which shows the findings, in one study (1948), made of the relationship. Each dot represents a crew picking for one day and is placed at a point representing both the yield and the rate of pick. The net-regression analysis indicates that $\rho = 0.827$ and that a significant relationship at the level of 1 per

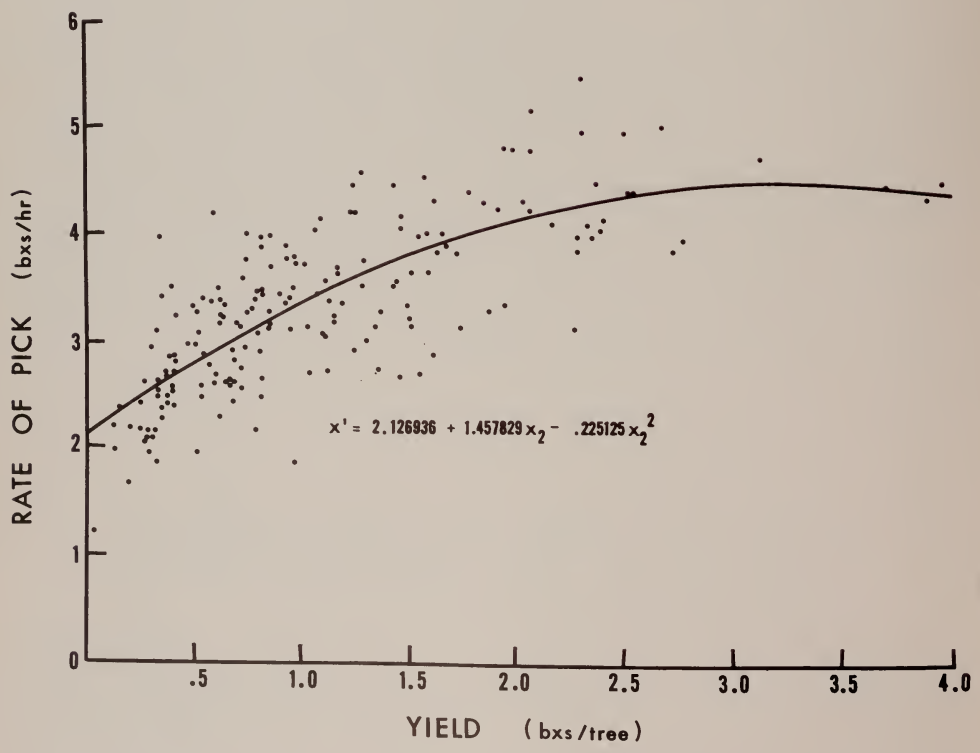


Fig. 6. Individual crew orchard picks, by yield and rate of pick, with curvilinear relationship, 1948 data. Source: Unpublished data, developed by the Statistical Laboratory, Dept. of Agricultural Economics, Berkeley.

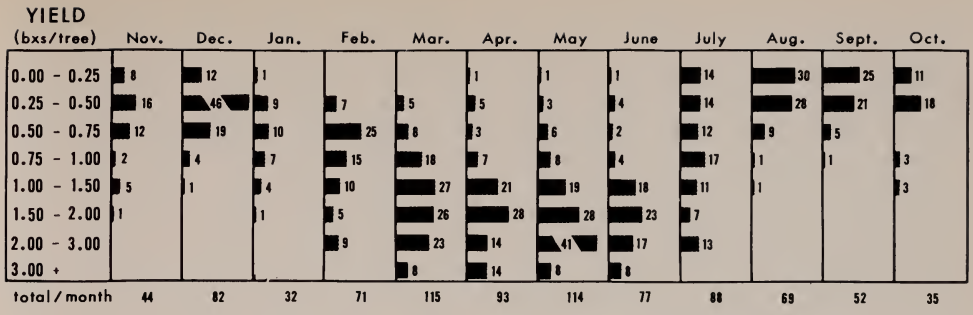


Fig. 7. Distribution by number of all individual orchard picks, by yield and by month, House I, 1954–55 data.

cent existed between yield and rate of pick. Apparently 68 per cent of the variation in rates of pick could be explained by the variations in yield.

The influence of yield differences as a picking problem is somewhat more complex than shown in the correlation formula. Figure 7 shows the successive number of picks in one packing house by month and by yield classification. This figure shows all 869 orchard picks made by the house. Some picks lasted an hour or two, some for several days. In some cases, where adjacent blocks belonging to one owner were all similar in character, the pick might include several of these blocks and might last for a couple of weeks. The essential point here is that each one of these picks presented a separate independent problem to management. The wide range in picking opportunities through the year from low yields to high yields and back again is emphasized in this figure.

Tree Height

Tree height is also a factor influencing the rate of pick. Table 2 shows the rate of pick relationship which our findings have recently developed. Figure 8 emphasizes the associated curved relationship between yield and rate of pick.

The great majority of orchard blocks in the county are classified as Class III, 9½ to 12 feet in height, which until this year was called the medium tree class. Consequently it has received most of our attention. It has offered the best opportunities for the development of reliable data and for establishing the fact that the relationship between yield and rate of pick is curved and that this curve is very close to that shown in figure 8.

Class I trees probably represent less than 3 per cent of the picking but are so markedly different that they form a special class. The pickers do not need ladders, and can move along rapidly. Although there is seldom much fruit in a pick and the pickers soon clean up an orchard, the exceptionally fast rate of pick justifies the class. The need for such a class has long been recognized but management was reluctant to use so many tree classes.

Class II rate-of-pick data are exactly halfway between Class I data and Class

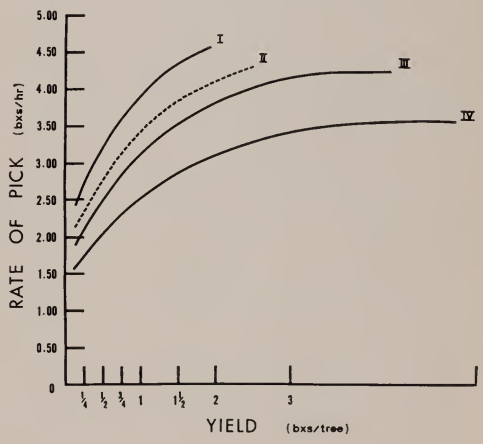


Fig. 8. Curved relationship between yield (bxs/tree) and rate of pick (bxs/hour) for four classes of lemon trees, Ventura County, 1963 data.
Class I—Picked without a ladder
Class II—Ladder-picked trees less than 9½ feet tall
Class III—Ladder-picked trees 9½ to 12 feet tall
Class IV—Ladder-picked trees over 12 feet tall

III data, and represent nothing more than a guess.

This Class II had never been set apart before 1963. In the course of our investigation we learned that several managements have come to treat the small-tree class (originally including all trees up to 9½ feet tall) as covering only non-ladder picking. Some of them were simply using the medium-tree-class schedule for the trees between the non-ladder picking and the 9½ foot level. Others were using a special rate schedule for these trees between the non-ladder picking and the medium tree class. The rate they were using was exactly halfway between what we had labeled the small-tree schedule and the medium-tree schedule.

The classification of extra large trees (more than 15 feet tall) has been eliminated in the county because, as an effect of pruning, apparently no orchard exists which can be classified as extra large.

The abandonment of the extra-large tree class (it could be called Class V) does not negate its value. If trees this tall are in the area, the class should be re-established.

Class IV rates of pick and rates of pay concern trees just over 12 feet tall, and not trees ranging from 12 to say 15 feet. The class might be described as of trees 12½ or 13 feet tall. Very few trees are more than 12 feet tall and most of them are found on sloping ground or on terraces where the system used for measuring tree height raised them to over 12 feet.

An examination of Class IV pay rates compared with those on smaller trees will make clear at least one reason why trees have been pruned down in height: the cost of picking is very high.

Lisbons. The schedules set up in 1944 and 1947 included a special provision for Lisbons. Lisbons typically were more thorny and more heavily foliated than Eurekas. Consequently, picking was more difficult and slower. To correct for this slower picking, the extra large class of trees, 15 feet plus, was defined as including all Lisbons taller than 12 feet (tables 4 and 5). This definition has now been abandoned along with the 15-foot-plus class of trees because Lisbons have become less common. The County Commissioner in a private correspondence reported in 1963 only 266,731 Lisbon trees out of 2,607,087 lemon trees in the county. In addition, the Eurekas now being planted along with the Lisbons are thornier and more heavily foliated making the distinction between the two varieties less clear.

Although it could be readily proved that many large Lisbon orchards were slower picking, the class limits or class rates of pick could never be clearly established in statistical studies. Any distinction between varieties in trees below 12 feet was found to be impractical. With so few trees existing now above 12 feet, the decision to abandon the Lisbon definition seems logical.

Nevertheless, the problem remains. If one orchard is more heavily foliated and has many more thorns than another, this will affect the rate of pick. The effect may be small enough to be easily balanced out. If not, another more rigorous study may be called for.

Ground Slope and Terraces. Sloping ground and terraces affect picking in three ways. It is more difficult to find a good spot on which to set a ladder. The walking and carrying of bag and ladder is more difficult. The height of the tree on the low side of the slope or terrace is greater. This last consideration explains the definition for measuring tree height: "the greatest height where a fruit might be picked above the lowest place for setting a ladder." The height of the tree is much less on the higher-ground side of the tree, an advantage which balances out the disadvantages of the more difficult walking and the more difficult placing of ladders.

Originally, this adjustment for ground slope and terraces had no statistical justification—it was a guess. Figure 9 represents an attempt to measure how accurately the adjustment has worked out. The picking was done in a single orchard of some 200 acres. The trees were quite uniform, all between 9½ and 12 feet tall, averaging 11.3 feet. The area varied as to terrain with flat low-ground and flat high-ground areas and with sloping ground and terraces in between. Crews of reasonable consistency in work characteristics were followed from day to day and the character of the terrain noted for each day.

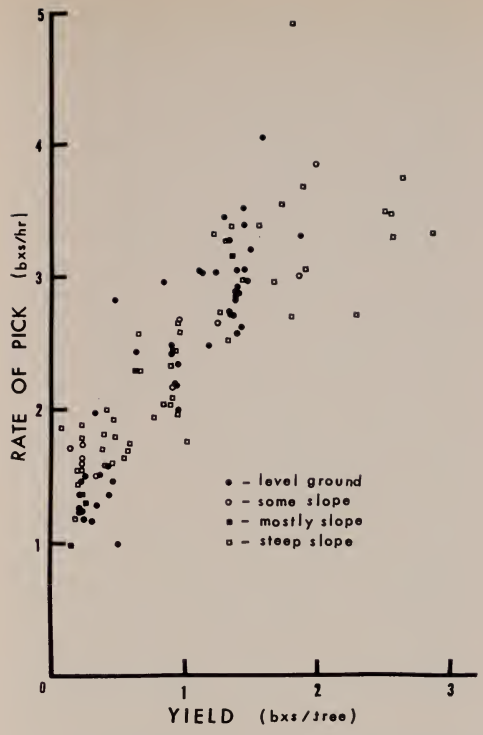


Fig. 9. Individual crew daily orchard picks, by yield and by rate of pick, by terrain conditions, one orchard, 1954–55 data.

Figure 9 shows the yield and rate of pick for each such day and the character of the terrain. By carrying out the study over a full year a complete range in yields was obtained.

Throughout the range in yields there is a consistently wide belt of rates of pick. There is also a quite uniform scatter of the different terrain conditions. The only noticeable exception to this scatter is in the low yields where the picking on level land seems to be somewhat slower. This seems to bear out the opinion, sometimes expressed by management, that the adjustment for sloping ground and terraces has favored the picker—he can earn a little more in such picking. Management however, does not object to this adjustment since it is felt that the slight extra earning compensate for the more difficult working conditions.

Size of Fruit

Size of fruit has been a troublesome factor to measure. It obviously affects the rate of pick when the rate is measured by a container of fixed volume such as a field box. Picks have averaged from less than 150 fruit per field box to more than 400. The effect on the rate of pick is not proportional but to the picker it seems extreme. Before the present-day wage system adjustment was developed, pickers and even whole crews would become discouraged when they encountered very small fruit.

The first attempt to adjust for size was to divide the county into two areas, the interior where smaller lemons grew, and a coastal area where larger sizes prevailed. Figure 10 shows one study made of sizes in various houses ranging from the most interior, Fillmore, to one just inside the coastal area, Saticoy. It will be noticed that Saticoy appears to have a materially larger size of fruit. The demarcation line between the two areas, interior and coastal, was made between Saticoy and Limoneira. The houses not named in figure 10 were either entirely coastal or largely so. Any fruit picked in the interior by them was to be paid for at interior rates.

It was known that size fluctuations occurred in every house in both areas and that an adjustment needed to be made

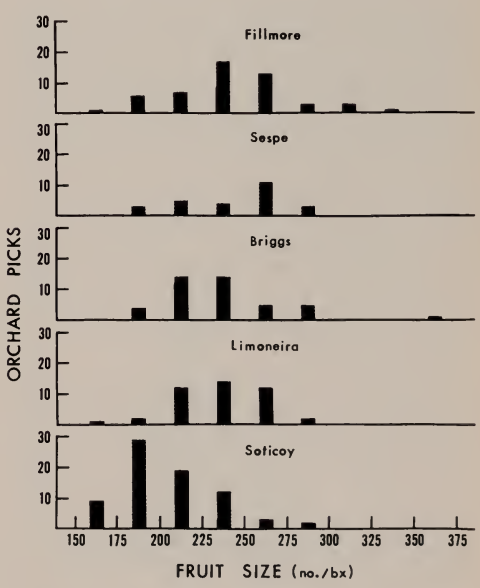


Fig. 10. Distribution of individual orchard picks by fruit size (number per field box) and by packing house, Ventura County, 1944 data.

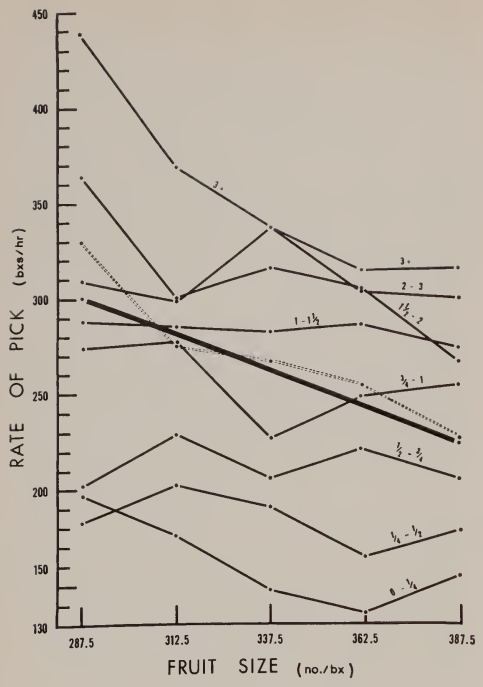


Fig. 11. Average rates of pick by fruit size (number per packed box), by rate of pick; over-all weighted rate of pick by fruit size (dashed lines); and net regression between over-all rate of pick and fruit size (heavy line); 1954–55 data.

among successive picks. It was also desirable to eliminate the two schedules of pay in the county. In the spring of 1954 the schedule shown in table 5 was developed, in which rates of pick were adjusted to fruit sizes. There was very little statistical support for the fruit-size differentiation rates but they were used until the spring of 1963. The schedule as shown was designed to return a level of earnings of 95 cents an hour. The actual earnings achieved (figure 14) were very near to or right at 95 cents.

Figure 11 shows one measurement attempt for fruit size. Trees were checked for height classification and special records were developed for fruit sizes. The fruit sizes shown refer to the old fruit-size classification used for the old wooden shipping case. The data reflect the picking of 1,619,550 boxes of fruit with 625,988 man hours of work.

Figure 11 indicates a wide diversity of relationships between fruit size and rate of pick. This diversity illustrates all our studies. It is evident that among the many influences affecting the rate of pick, fruit size is of varying importance.

Close observation of crews, moreover, indicates that fruit size has a peculiarly psychological influence. The small sizes fill a bag so slowly that a picker becomes discouraged. The discouragement in itself slows the picker and its effect spreads through the crew. Something similar occurs sometimes with large sizes: they speed up the picking, but if it becomes faster than normal, the picker tires and an automatic adjustment soon takes place. The psychological relationships quite likely add to the erratic influence of fruit size on rate of pick.

There is, however, a general relationship between fruit size and rate of pick, expressed in the slope from left to right in figure 11. The dashed lines represent slopes between the weighted average rates of pick in each fruit size class and the heavy line is a linear regression description of the successive rates of pick. It is pertinent to note that the slope shown of $-0.007897\ x$ is supported by the finding of a 1948 study showing a slope of $-0.007669\ x$ (see figure 6).

The special fruit size records used in the above analysis were obtained from the sampling data now used by all cooperative lemon packing houses in crediting growers with their pick. This sampling data is an elaborate and highly accurate system applied to every lot of fruit received. This data was paired with the daily crew reports and an exact picture obtained of the fruit sizes picked by each crew each day in each orchard.

The method appears to be applicable as a commercial means of obtaining fruit-size data for the payment of crews. Its problems of time lag and of accounting procedures are not particularly serious. Management will find it advantageous to use an impersonal satistically sound fruit-size description. The present method, to be accurate, requires a sample larger than five boxes, something which is difficult for the busy crew boss.

Fortunately the three fruit-size classes are so set up that serious error can be avoided by the crew boss if he uses good

judgment. The important thing is to place extremely large sizes or extremely small sizes each in their own class, separated from the average. This the crew boss can pretty well do from what he can see as he works with the crew and the fruit. Errors will occur but not serious ones. We suspect that the main help from the counting and recording of the fruit from five boxes is the emphasis it gives to the problem.

It will be noticed that the fruit size classification used in tables 1 and 2 is different from the one set up in 1954, table 5. The dividing number of fruit between the medium and large is changed from 250 to 240. The original choice of 250 was merely a guess at a good demarcation line. A number of studies of fruit sizes had been made but they were not necessarily representative of the county-wide production. There was no time to make further studies. The situation in the spring of 1963 was not a great deal better but some information was available. Table 8 shows the information available when the new schedule was set up.

Table 8. Orchard picks classified as to fruit size and numbers of orchard picks with fruit counts available, by fruit size class, Ventura County, spring, 1963.

	Fruit size class *fruit/field box*		
	Under 250	250–300	Over 300
Orchard picks classified.....	*889*	*1,152*	*318*
Per cent.....	38	49	13
Orchard picks counted.....	*669*	*741*	*216*
Average count (fruit/box).....	228	267	325

From looking at table 8 one might conclude that no change need be made. The average count of the small fruit was 25 counts from its line while the average count of the large fruit was only 22 counts from its line. However, the change over from 250 to 240 was made for the following reasons. The average count for the 250–300 class was 267, far closer to 250 than 300. In fact, it is only 17 from 250 but 33 from 300. Also it is only 39 from 228 but is 58 from 325. We are quite certain the fruit sizes in the county are skewed toward the small sizes, as is indicated by these data, but some of this skewness would still be allowed for with the 240 demarcation line. Also, the system is set up only to take care of extreme sizes. A portion of 38 per cent in the large fruit size class seemed excessive for such a purpose.

Since that decision was made, a frequency distribution has been made of all the size county data available of 1962 picking. A total of 3,906 orchard picks were included involving several million boxes of fruit. Figure 12 presents a bar-chart picture of these sizes. Picks ranged in fruit size from 150 per box to 424.

Figure 12 shows a relative evenness of the slopes. In general such evenness indicates a degree of reliability in the data. The counts made of fruits in the sample boxes must have been reasonably accurate and objective. Whether in any given orchard the sample was representative is another matter but an objective count of boxes chosen by chance would, in the numbers used here, result in a smooth curve. The crew bosses who count the fruit apparently are doing, within the limits of their instructions, a good job.

Does the data indicate whether the present-day dividing lines for fruit sizes at 240 and at 300 are well chosen? The 300-plus group is far smaller than the 240-minus group. The 240-minus group has 1,468 orchard picks, the 240–300 group has 1,908, and the 300-plus group has 530.

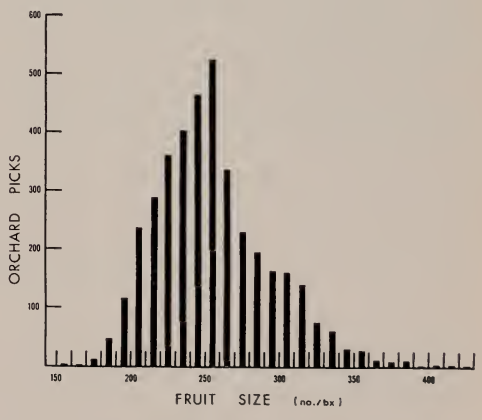


Fig. 12. Distribution by number of orchard picks, by fruit size (number per box), 1962 data.

One might argue for a more equal division or at least a division centering on the median peak in the bar chart. On the other hand, the skewness to the right plus the psychological importance of the small sizes may justify keeping the dividing line to the right. Also the 240 dividing line leaves a group on the left which is largely clustered together into a quite uniform grouping. Further study is called for before any further change is justified.

Other Variables

There are many other variables which influence the rate of pick. The distribution of fruit over or within the tree and the radius of the tree surface from the trunk can have an important influence. Trees skirted down low and loaded with fruit can slow workers materially. Heavy ground cover, soft dirt, rough ground, and wet conditions inevitably slow workers. Room for walking and carrying bag and ladders also may influence rate of pick. These variables present three kinds of problems.

One problem is the definition of each variable so that a clear demarcation can be made as to whether a particular pick should be classified one way or the other. For instance, one can easily determine that low tree skirts slow a picker. At what point, however, should one draw a line between a low tree skirt and the other tree skirts? The height of skirts varies with the load of the fruit so measurement might be required with every pick. The question does not seem insoluble but no good definition, acceptable to management, has yet been worked out.

The second problem is the measurement of the variable's influence. We have measured certain extreme cases in which the height of tree skirts played a part but any measurement of a general class has been inexact enough to raise a question as to its validity.

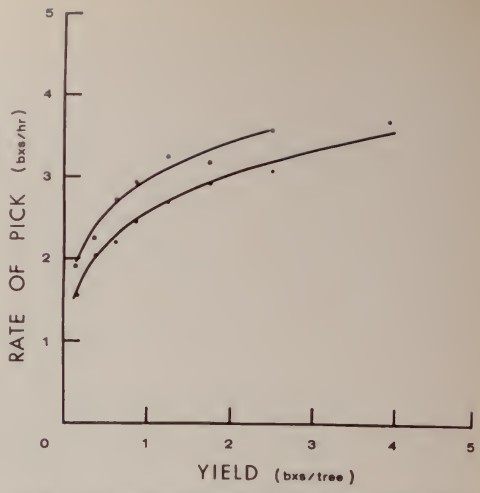


Fig. 13. Average rates of pick for each yield class, with log curve fit, by two age classes of trees, 1954–55 data. Circles indicate trees less than ten years old. Dots indicate trees ten years or more in age.

The third problem is to determine whether the differences justify a special rate or a special definition. The problem may not be important enough to justify such a step.

Age of Trees. Figure 13 shows the contrast in rate of pick when trees are classed by age. The distinction is clear. Probably the main reason for the difference is in the radius of the tree, the older trees being larger and more difficult to get into. Other features of the trees may play a part. Some thought has been given to making tree age a factor in classification but the exceptions to the above measurement are too numerous to make such classifications worthwhile.

EARNINGS STABILIZATION

The tree production wage system aims at earnings stabilization—the capability of a wage system to eliminate or reduce the impact of orchard variables on earnings. Any measurement of the extent to which earnings are stabilized (or the impact of orchard variables reduced) is highly applicable to our problem. The method of comparison is to use, on the one hand, the actual earnings received under the system;

on the other hand, we developed an overall average "single rate" of pay in cents per box by dividing the actual mean earnings of all crews for all days by their mean rate of pick in boxes per hour. Our rates of pick as actually achieved in successive orchards were then multiplied by this single rate of pay. This single rate of pay per box would reflect all orchard influences on rate of pick and serve as a basis from which to determine the modifying influence of the tree production wage system. Specifically, the impact of orchard variables on earnings is reflected in the weighted daily average standard error of the mean (σ_m) for all crews, the daily σ_m for each crew being determined from each crew's overall M average for the two-week period. The earnings stabilization achieved by the tree production wage system as measured by the amount σ_m is reduced under the tree production wage system as compared to the single-rate system. The analysis is made independently for both January and May.

January analysis

	Tree production system	Single rate system
M (all crews, all days)	93.4 ¢	93.4 ¢
σm	±10.4 ¢	±15.3 ¢
$\rho 2 = 1 - \frac{\sigma m^2 \text{ (tree production)}}{\sigma_m^2 \text{ (single rate)}}$	54%	

May analysis

	Tree production system	Single rate system
M (all crews, all days)	111.4 ¢	111.4 ¢
σ_m	± 10.7 ¢	± 14.8 ¢
$p2$	48%	

As compared to a single-rate incentive system, the tree production system has reduced σ_m from ± 15.3¢ to 10.4¢ in January (a 32 per cent reduction) and from ± 14.8¢ to 10.7¢ in May (a 30 per cent reduction). In January, 54 per cent of the variance can be explained by the use of the tree production system. In May it was 48 per cent.

The residual standard errors consist of four variables:

1. Unmeasured orchard variables
2. Crew membership changes
3. Crew effort changes
4. Crew experience changes

Items 2 and 3 can be largely ignored as not important, at least in a large sample as we used. In a small sample, variations might develop. Item 4 could have been important in January but we have no evidence of it.

Our conclusion is that about one-half of the inherent orchard-to-orchard variations are eliminated by the tree production system. The logic of this system indicates that its influence on the variations would be most pronounced where the variations are extreme. Thus the benefits of the tree production system could well be greater than the figure one-half indicates because of the psychological effect that extreme variations in workers' earnings would have on the workers' interest in their job.

Remaining Instability

Earnings under the tree production system, however, are far from completely stabilized. This remaining instability was illustrated in a study made of 11 individual pickers over a sequence of 70 work days in 1954–55. All men were experienced at the start and all worked in one packing house under a common picking policy. They were scattered through several crews and the sequence of their successive work days was not the same; consequently, they were not all subject to the same successive orchard-day influences. They encountered the normal variables in orchard days.

The average hourly wage for the 11 men was 90.4 cents per hour. The standard deviation among workers in wages was 14.8 cents per hour which means that 68 per cent of the workers earned between 76 cents per hour and 105 cents. These are differences largely due to individual picker characteristics.

The average standard deviation of the individual pickers from day to day was 15.9 cents. This means that on 68 per cent of the days this average picker earned between 74.5 cents per hour and 106.3 cents

per hour. Or, one can say that 16 per cent of the time he earned less than 84.5 cents per hour and that 16 per cent of the time he earned more than 106.3 cents. Also, at the $\pm 2\sigma$ levels, one can say that 2 per cent of the time he earned more than 122.2 cents per hour and that 2 per cent of the time he earned less than 58.6 cents per hour.

It is important to recognize that the 90.4 cent M value used here is below an intended level of earnings of $1.25. Conversion to this level can be done by a percentage adjustment, σ being made equal to $\pm$ 17.6 per cent and giving us the following values:

$+2\sigma = \$1.69$
$+1\sigma = \$1.47$
$M = \$1.25$
$-1\sigma = \$1.03$
$-2\sigma = \$0.81$

These values indicate the day-to-day fluctuation in earnings which can be anticipated by the average experienced worker. The $\pm 1\sigma$ values include 68 per cent of the days. The $\pm 2\sigma$ values include 95 per cent of the days. Less than 5 per cent of the days will be outside the $\pm 2\sigma$ levels. The picker's deviations from M will be equally divided between higher and lower levels. These figures are close to those in table 13 ($M = \$1.25$), developed on a completely different set of data.

The above differences are largely due to differences from orchard-day to orchard-day. It is apparent that important variables in the orchards are not yet adjusted for. While the representativeness of our sample in this particular study may be questioned, the general conclusions seem well established.

BACKGROUND TO CURRENT PROBLEMS

The intent of this bulletin is to describe lemon picking and the tree production incentive wage system. The over-all situation being dealt with, however, is one in which the industry is having to adjust to changing economic conditions. Returns are low and wage costs are rising; the grower is caught within the scissors of costs and returns. In consequence, picking methods are being changed in order to reduce costs. The changes in methods involve changes which in themselves increase the earnings of pickers and so have to be accounted for in our description of the wage system and of earnings under it.

The Grower Income Situation

The financial returns received by growers in recent years have declined seriously from those received in the past. A few figures will quickly show how serious this decline has been. Grower income (on-tree crop value less cultural costs) for the industry as a whole is estimated by Sunkist Growers (1961 and 1963) as follows:

Five year average	*Income per acre*
1934–35 to 1938–39	$113
1939–40 to 1943–44	117
1944–45 to 1948–49	72
1949–50 to 1953–54	235
Crop year	
1954–55	99
1955–56	132
1956–57	20
1957–58	27
1958–59	–63
1959–60	–31
1960–61	–22
1961–62	–31

The income shown in these figures does not provide for any return on investment in land or for any amortization charges to

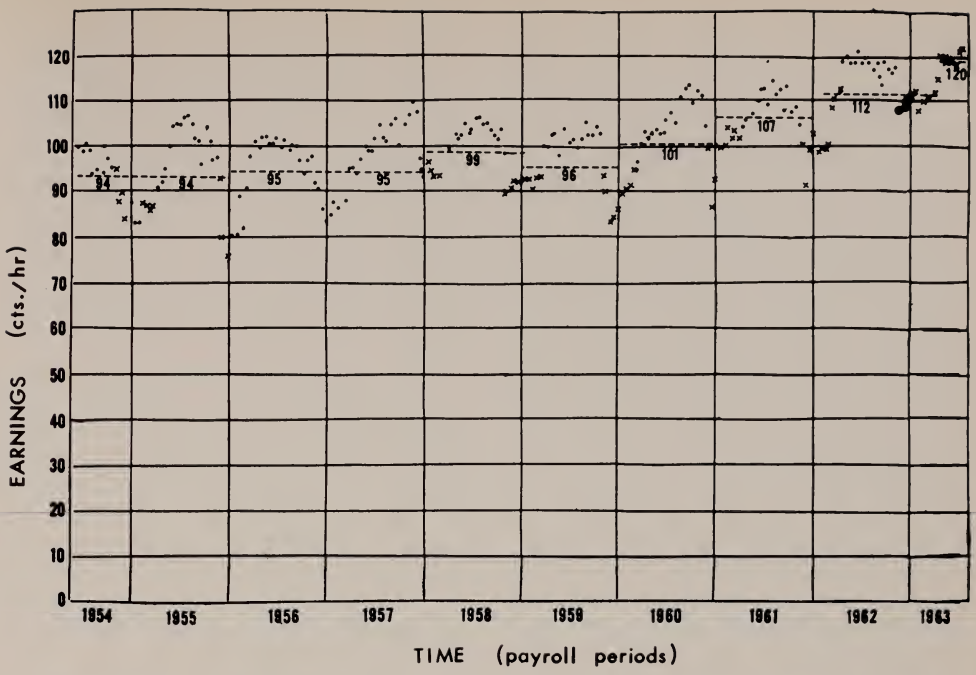


Fig. 14. Average earnings per payroll period, all bracero crews, five to seven packing houses, 1954–63. Dots designate experienced crews, crosses crews with a significant number of inexperienced workers, and the two circles (in 1962) crews with transfers from orange crews.

be levied against trees. As shown, industry income has been low in recent years.

These low returns to growers are largely due to the high proportion of fruit sold in processed form and the low price received for it. The pertinent data in dollars per packed equivalent box shown in table 9 indicate that the prospect is discouraging. (Smith, 1961)

Rising Wage Levels

Wage levels have been rising in American agriculture. The USDA Statistical Reporting Service (1963) reports the index of farm wage rates for July 1, 1963 at 117, as compared with a base of 100 in 1957–59.

Figure 14 presents a picture of earnings in Ventura County lemon picking. The horizontal scale represents the succession of payroll periods since April, 1954. The vertical axes show the level of earnings. Each dot, cross, or circle indicates the average earnings per hour for that specific payroll period. The dots represent payroll periods when only experienced men were picking the crosses represent payroll periods when significant numbers of workers were inexperienced, and the two circles represent crews that were shifted over from orange picking. The decision whether to use a dot, a circle, or a cross for a payroll period depended not only on the arrival

Table 9. On-tree lemon values per equivalent packed box, fresh fruit and processed, with per cent of crop processed, for years shown.*

Five-year	On-tree values		Per cent
average	*fresh*	*processed*	*processed*
1934–35 to 1938–39	$2.19	$0.25	19.7
1939–40 to 1943–44	2.18	0.24	32.7
1944–45 to 1948–49	3.08	−0.12	29.7
1949–50 to 1953–54	3.48	1.01	37.1
Crop year			
1954–55	2.95	0.14	34.4
1955–56	3.28	0.38	31.9
1956–57	2.45	0.12	40.6
1957–58	2.24	0.20	40.3
1958–59	2.64	−0.38	49.2
1959–60	2.53	−0.32	48.4
1960–61	2.34	0.14	32.6
1961–62	2.47	0.09	46.7

* Sunkist (1961 and 1963).

of a new contract group at or just before the start of that period, but also on their arrival some weeks earlier because their inexperience carried over for some time. While judgment was used in these matters, the data as to when such men arrived, were exact.[6] Data as to the use of inexperienced men were not available for 1956 and 1957.

The data on earnings per hour were of all houses from which they were available, varying in number from five to seven, depending on the year. To keep data representative in one case we left out available data because that particular packing house in that year used locals with quite different earnings, not at all representative of the rest of the county.

An important feature in figure 14 is the wave or cyclical form taken by the succession of payroll earnings. In the winter, earnings were low. In the summer, earnings were high. Examination of the cyclical form indicates that the low position is associated with the use of inexperienced men.

The dashed lines in figure 14 show the average earnings for longer periods, commonly a year. The average of $1.12 for 1962 is 15 per cent above the average of 97 cents for 1957–59. The average of $1.20 for the summer of 1963, with the new rates of pay using inexperienced pickers, is 24 per cent above 1957–59. This latter figure is higher than the 17 per cent increase in farm wages for the United States as a whole.

The increase in earnings up to the spring of 1963 was due to changes in picking techniques. This increase is discussed in the next section. On April 1, 1963, a higher rate of pay schedule was adopted and the subsequent rise in earnings, even though inexperienced pickers were used, was due to the rates of pay. On January 31, 1964, a still higher rate of pay schedule was adopted, with an intended level of earnings set at $1.30 an hour.

CHANGES IN PICKING PRACTICES AND STANDARDS

In recent years, the following significant changes have been made in picking practices:

1. A longer interval is allowed between picks. Where formerly an orchard was picked from six to eight times during the year, today the normal practice is to pick four to six times.

2. The double clip is no longer insisted upon. Instead, pickers used the single clip wherever possible. Long stems are objected to but clipper cuts no longer cause concern as they once did.

3. The fruit is dropped into the bag less carefully. The bag is handled less carefully. The bag is emptied into the box without the care once insisted upon.

4. The picker is not required to use the ring so much.

5. A specific color line is not held to so rigorously.

6. Ground fruit is picked up where formerly it was prohibited.

All these changes speed up picking without, however, any change in the rate of pay schedule. Under the first change listed above, the grower received a direct reduction in cost because the picking was done in a higher yield class. The pickers' earnings were not changed because of the inherent rules of the tree production wage system. Under the other five changes listed, the pickers' earnings per hour were increased but the grower received no change in his direct labor costs; the grower gained, however, in the reduction of overhead costs brought about by fewer men being required with the faster picking.

Measurement of Change

The amount of the change in practices and standards is measured in table 10. In this table the rates of pick for 1947 were taken from the rate of pay schedule set up in 1954 (table 5) but that schedule was adapted from the rates of pick of 1947 (table 4). Table 10 shows that in every

[6] From the office files, Ventura County Citrus Growers Committee.

Table 10. Percentage changes in rates of pick, with number of orchard picks, five houses, A, C, E, F, and H, and average rate of pick achieved with per cent change, three houses, A, C, and E, 1947 to 1962, medium trees, fruit sizes of 250–300 (fruit per field box), by yield classes.

Yields	1947 rates	Packing houses											
		A		C		E		F		H		A, C, and E	
		Picks	Change	Picks	Change	Picks	Change	Picks	Change	Picks	Change	New rate	Change
bxs/tree	*bxs/hr*	*number*	*per cent*	*number*	*per cent*	*number*	*per cent*	*number*	*per cent*	*number*	*per cent*	*bxs/hr*	*per cent*
0–¼	1.57	4	+32	19	+32	9	+18	10	+17	—	—	2.01	+28
¼–½	1.90	23	+30	22	+37	23	+23	36	+17	9	+32	2.47	+30
½–¾	2.20	13	+28	41	+26	30	+25	21	+26	12	+39	2.77	+26
¾–1	2.46	12	+23	29	+23	44	+22	41	+28	6	+42	3.01	+22
1–1½	2.77	43	+21	35	+21	56	+20	49	+32	11	+35	3.34	+21
1½–2	3.05	42	+16	26	+11	55	+21	40	+27	16	+31	3.58	+17
2–3	3.31	32	+ 9	13	+12	65	+21	80	+28	14	+29	3.85	+16
3 +	3.54	15	+14	4	+27	43	+26	98	+30	11	+31	4.36	+23

yield class in all houses there was a marked increase in rate of pick. The picking records of Mexican nationals with at least two months experience were used for the comparison.

Examination of the increases in Houses F and H shows that the increases in those two houses were materially greater than in the other three. The over-all yield increases were 27 per cent and 33 per cent, respectively, while in the other houses they were each 19, 23, and 22 per cent. Discussions with the managements of these two houses revealed that in their attempts to increase the rates of pick, they had probably overstepped the bounds of necessary quality. Special circumstances such as delays in picking and exceptional yields encouraged them to experiment with more rapid picking techniques. The managements of both houses, F and H, recommended that their data be disregarded.

The average rates of pick data for Houses A, C, and E were used in setting up the rates of pick schedule in 1963. Similar data and findings were developed for the other two fruit-size classes and for small trees and large trees not included in the table. The whole schedule (table 2) represents a process of smoothing, averaging, and adjusting so that the relative rates of pick in all classes are logical.

The amount of the over-all change in rates of pick can best be seen by the change in earnings shown in figure 14. The increase of over-all earnings in 1962 over earnings during 1957–59 is estimated at 15 per cent. If one takes the mid-year level of earnings in 1962 as averaging 118 cents and compares it with the intended level in 1947 of 95 cents, the percentage increase is 24. This change of 24 per cent best reflects the long-time change that has occurred in rate of pick. In terms of reduced costs, however, two additional items should be mentioned. First, the longer interval between picks lowers over-all costs to the grower but would not be reflected in the above measurements; the lower costs are due to higher yields in a pick, due in turn to the longer intervals between picks. Second, the faster picking reduces the number of pickers; this change will lower overhead costs, particularly in the long run.

The data collected in January and May, 1962 (see pages 21 and 31) provide another measurement of these changes. These data are particularly pertinent because managers state that important steps in making these changes were taken in the spring of 1962. The comparison of the two months of both earnings and of rates of pick is as follows:

Earnings

May crews:
$M = 111.4¢$, $\sigma = \pm 22.2¢$, $N = 2{,}374$

January crews:
$M = 93.4¢$, $\sigma = \pm 27.0¢$, $N = 2{,}617$

Rates of Pick

May crews:
$M = 3.49$ (bxs/hr), $\sigma = \pm 0.835$, $N = 2{,}374$

January crews:
$M = 2.74$ (bxs/hr), $\sigma = \pm 0.836$, $N = 2{,}574$

It is to be noted that, based upon the total variance between pickers from all causes, the above differences would be highly significant if two random selection of pickers, one for each period, were made for the comparisons. In actuality we used the same houses and crews for both periods which means that only the outside variance due to orchard conditions and new pickers have a random effect upon the comparisons. Variance due to orchard conditions account for about 24 per cent of the total variance and due to picker variance for about 64 per cent of the total variance. Since, at this time, we do not know the extent of crew personnel changes we have not attempted to compute specific F values for this comparison. Three factors may be thought of as responsible for these changes in the spring of 1962.

1. In January there were many new pickers as compared to May. The January data covered the period from January 8 to 27.

The pertinent new-worker data are as follows:

Date	New contracts	Number employed	
		Lemons	Oranges
11/23/61	68	986	314
11/30/61	322	1,515	43
12/7/61	39	1,475	90
12/14/61	138	1,626	42
12/21/61	250	1,921	42
1/11/62	162	2,004	35
1/18/62	160	2,559	92
1/25/62	102	2,549	92

The date given is the day the new contracts (new bracero employees) arrived. The summation of these data is not complete because we have not included data as to furloughs, repatriation, workers missing, etc., but the data do show the exact number recorded as working in each crop. All new workers very probably went into lemon picking. By January 11, 1962, the new workers could have constituted 817 out of the 1,921 total on that date, or 43 per cent. They would have arrived within the previous seven weeks or much more recently. Picking is usually light at this season and it is doubtful if they worked more than 35 work days; probably less.

In May, the data extended from 5/7/62 to 5/25/62. The pertinent new contracts and number employed were as follows:

Date	New contracts	Number employed	
		Lemons	Oranges
2/1/62	40	2,638	128
2/8/62	65	2,698	128
2/15/62	36	2,720	126
2/22/62	60	2,779	135
3/1/62	36	2,729	173
3/8/62	121	2,881	177
3/15/62	224	3,075	192
4/12/62	30	3,199	15
5/3/62	120	2,627	145

The 120 who arrived in May went into oranges. The 30 who came in April would still be inexperienced in May. The 381 who came in March constituted 12 per cent of those on hand by March 15, but by May 7 they would have had 45 work days of experience, as picking is heavy then and the six-day week is common. Those who came in February would be called experienced by May. Therefore, the pickers in May were largely experienced and quite in contrast to those of January.

2. Picking in May is quite different from that in January. Yields, for instance, are twice as high in May as in January. These differences would affect the rate of pick but with the tree production wage system there should have been no particular effect on earnings.

3. The third factor was the change in practices and standards with which we are concerned here.

We have no way of differentiating among these causal factors except as noted. Figure 14, however, shows that earnings made an exceptional surge upward during the first half of 1962. The influence of gains from experience was repeated each year but management assures us that in the spring of 1962 they were giving exceptional attention to the new practices.

Management Considerations

These changes in picking practices with which we are dealing might better be called changes in standards. The high quality of lemon merchandising over the past years led to the development of a viewpoint that certain practices were essentially standard in objectives and procedures. Every fruit was to be so grown, harvested, and sold that it would be as near a perfect specimen as possible. It was granted that as a practical matter such a standard could not be attained to perfection, but in the specific handling of each fruit, packing houses tried to uphold this standard as much as possible.

The present economic situation of the lemon industry has forced a change in this attitude. Costs must be reduced. Moreover, with a large proportion of the fruit being diverted to juice, the value of any par-

ticular fruit becomes of no consequence. Since many must be diverted to a no-value outlet, no care need be exercised in their handling. This economic situation and change in attitude along with changes in packing-house practices made possible the changes in picking practices which have been outlined.

Lemons are marketed under a control program. A prorate system has been in existence under federal law since 1941. Before that, since 1924, it had operated on a voluntary basis under the control of Sunkist. The present law is administered by an industry organization called the Lemon Administrative Committee. This committee sets the quantity of lemons which may be marketed fresh each week. This right to ship fresh is distributed among the packing houses according to the proportion each house is "credited" with having in storage.

Lemons are always stored. Some are stored for only a few weeks but most are stored for several months and some for six months. The original purpose was to adjust supply to demand but it was soon discovered that storage improved fruit quality.

In 1955, the Lemon Administrative Committee made an important change in its system of allocating prorate rights to ship. Previously, all lemons received in the packing house were given a "count" which in substance was an estimate of the probable storage life of the fruit. This count determined the number of weeks (up to 24) of storage life with which the fruit would be credited and during which period the packing house would have this fruit to establish its proportion of the industry-wide fresh shipments. Since each house was allowed to ship to the fresh market only in the proportion its total count was to the industry-wide count, this count was the controlling factor in the amount of fruit a house could ship.

The count a fruit received depended on its estimated storage life, and this, in turn, depended on the fruit's color, from yellow through silver and light green to dark green. The colors progressively gave a larger count, so the house tried to pick fruit as green as possible. The only factor that forced a fruit to be picked at lighter colors was its failure to attain a large enough size for marketing. Skill in picking fruit so that it would have a maximum count was a prime consideration in management.

Short intervals between picking were often necessary to obtain the best possible "color" for storage and the prorate count. Sometimes intervals between picks would be as brief as two weeks. Orchards were occasionally picked when they had no more than a dozen fruit on a full-grown tree. Other factors such as the current market value of the fruit played a part in these decisions, but the count always received consideration.

This count method, however, was demonstrated to have certain inequities and, as a result, the lemon industry abandoned it. (Smith, 1953). Technically, all fruit came to be credited with the same count. The advantage of "picking green" was lost to some extent. Fruit could be left on the trees longer without a serious loss in fresh-shipping rights. This change in the count method was an important step in the present conversion to longer intervals between picks.

Also, less attention could be given to picking on a specific color line. In former years management often instructed pickers to pick only when the yellowing or silvering had progressed to a "line" where the green part had a radius of say one-half inch from the stylar end. This line was sometimes given a great deal of emphasis, and was changed from season to season and from orchard to orchard. Today, this policy is of less importance.

Another important operational change is a greatly increased diversion of fruit to products at the washer. The phrase "at the washer" refers to the processes of cleaning and sorting before fruit goes into storage and is a very elaborate expensive process, using large machines. Many houses employ electronic equipment to sort for color, and all use many graders to sort for quality. These processes along with storage constitute a heavy expense item and have had to be examined accordingly. For 25 years at least a third of the crop has usually gone to products and brought a low return. The economics of diverting fruit to products before or during the washer op-

eration rather than after storage was obvious. The first real possibility of substantial diversion came about 1950 when a storage "count" was allowed on fruit diverted at the washer even though it never went into storage. Sampling systems were installed for all such fruit so the prorate administration and packing-house management could have necessary information on the storage count of diverted fruit. Large quantities of fruit began to be diverted and large bulk-handling facilities were installed for them.

With easy diversion at the washer established, fruit which might not be desirable in storage could be sorted out at the washer. An important consideration in lemon handling is the question of whether fruit is strong or weak, with regard to storage and retail shelf life. Management has a detailed knowledge of such matters and tries to avoid storing fruit which will not keep. If rotting develops, sorting later on is expensive. By immediate diversion, a lesser expense is incurred.

This possibility of diverting weak fruit and still obtaining from it a due proportion of industry right to ship under the prorate is important in the recent changes in picking practices. In former years every effort was taken not to allow fruit to stay on the trees until it had reached this "weak fruit" stage. Today there is far less concern about it. This situation makes possible longer intervals and less attention to the color line.

The diversion also permits greater freedom in clipping practices. Faulty clips, such as long stems or clipper cuts on the fruit, can be seen at the washer and diverted. The fruit will be processed before decay can set in.

Another important development in the packing house has been the use of new chemicals and of better temperature controls. Hormones seem to strengthen the storageability of fruit. The common blue and green molds are usually well controlled. What was once an everpresent danger, that of losing entire storage lots to mold, is now largely a thing of the past. Bruising of fruit in orchard handling as well as the more easily seen clipper cuts are of less concern.

The over-all change lies in the decreasing value of individual fruit. There is no urgency to develop each fruit to its maximum perfection. The situation is being appraised more cold-bloodedly. The ring is disregarded. Fruit too large for fresh-fruit sale simply goes to products. Faulty size, faulty color, clipper cuts, and bruising are given far less attention than formerly.

But this relaxation of old standards must not be taken as a relaxation in management responsibilities. The old rigid, fixed methods were probably, on the whole, easier for management than the present methods. In the past the criteria were fundamentally simple: how to make every fruit develop to its best. Today the judgments required are more complex, a wide diversity of economic and biological factors have to be weighed. There is no clear direction to follow. The demands on management have been materially increased.

Prospects of Further Changes

It is difficult to overemphasize the importance of impending changes in practices and policies and the resultant increase in earnings and decrease in costs. The lemon industry, from its beginnings, has made use in its seasonal tasks of what can best be described as indigent labor. By and large this labor had no other opportunities for work and, being in large supply, it had to work for very low wages. Whatever the wage level, a worthwhile living is hardly possible when work is available for only part of the year. Only their poverty could persuade these people to stay with seasonal jobs. The energetic, capable workers always moved on to year-round work.

The long-term dominating consequence of cheap labor is negligence in its economical use. Little attention is given to its efficiency (Phelps-Brown, 1962, p. 57). Only as the scissors of lowering returns and rising costs began to cut profits has citrus management begun to give attention to picking efficiency. The first results have already been described. There are other and more important possibilities ahead, however. The use of better clippers has been proposed (DeGarmo, *et al.* 1952); the reduction of carry distance could be important (Smith, 1956); bulk containers will

Fig. 15. University tree working machine for picking fruit. Machine follows furrow down row of trees. Picker moves himself over tree, picking fruit into a pouch between his legs. A single-man operation. Machine developed under contract between University of California, Riverside, and Space Equipment Corporation.

help (Smith, 1949: Perry, *et al.*, 1959; Smith and Perry, 1961); and training, discussed in the next section, can be a significant factor.

However, the most important of these improvement possibilities is the development of a tree-working machine as a mechanical aid for picking fruit. Figure 15 shows such a machine (Smith and Seamount, 1962). It would eliminate ladder and bag. The resultant lessening of fatigue and the accompanying greater speed in moving through the tree would do much to expedite the work. It is estimated that rate of pick will increase from 2½ to 4 times, depending on variety and conditions. The machine still has to be improved both in design and use.

An essential element in the success of any such machine would be the use of a proper incentive. The picker will make the best possible use of such equipment only if earnings can be stabilized on a day-to-day basis and only if extra effort brings a proportional reward. Mechanically it will be easy to count the fruit and, in consequence, the incentive will probably be related to number of fruit picked rather than to volume; thus an adjustment for fruit size can probably be eliminated. Tree size will become unimportant, except as large trees reduce travel. The only real variable will be fruit density. While no direct relationship of incentive rate to fruit density has yet been established, we have no reason to think it cannot be done. A density rate schedule would simply reflect the relationship between numbers of fruit and tree volume.

With these mechanical aids, with improved methods, and with proper incentives, a materially better opportunity for the worker will result. With investments in mechanical aids and with the development of experienced crews, management will strive to extend the work season to its maximum. Fortunately, California citrus offers exceptional opportunities in longer work seasons in these seasonal tasks; the bracero program has demonstrated the fact. Therefore, a strong and reasonably reliable work force can be developed. The resulting over-all improvement in earnings and attainment of lower costs could be most important.

IMPORTANCE OF EXPERIENCE

Picking lemons should be treated as a semi-skilled task which requires both time to learn and a great deal of strength and stamina. The bag is heavy and cumbersome and some muscles may need to be toughened up to handle it. This takes time. Handling the bag on a ladder or when reaching up or bending over or when kneeling on the ground requires practice. The clipper is awkward to hold at first, particularly when one attempts to clip rapidly. Many pickers develop hard callouses on the hand before they can handle their clippers with ease.

The required care in handling of fruit slows a person seriously. The ring, held by the left hand, is a great nuisance. The ladder is bunglesome to handle and tiring to climb or balance on. It must be so set

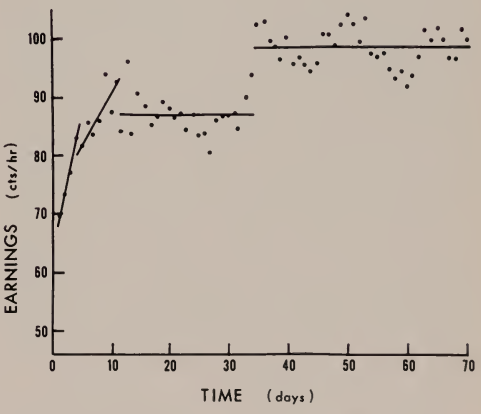


Fig. 16. Average earnings each day for beginning pickers, House C, first day of work through 70 days of work. Linear trend lines shown for successive groups of days.

up that it will not damage the tree, that it will enable the picker to collect a maximum of fruit, and yet not require him to reach too far for fruit. The whole task requires at least two months of training and experience before a man can be regarded as a competent worker.

The previous section on changes in picking practices and standards has indicated that the changes during the spring of 1962 could, in part at least, have been related to the experience of the pickers. See data on pages 34 to 37.

Figure 16 presents data on the rate of pick each successive day of men newly assigned to a packing house, House C. These pickers were listed in succession as they were assigned. The day shown for a picker, while the first, second, third, etc., for him, was not on the same calendar day for all. Workers were assigned to the house over a period of several weeks in groups of varying size. Since they worked in 12 different crews and since each worker's specific day differed from that of the others, varying orchard conditions would tend to cancel out.

The vertical axis of figure 16 shows the average level of earnings and the horizontal axis the successive work days. Each dot represents the average earnings per hour of the whole group on the day of employment shown. The first four days reveal a very sharp rise in earnings, from 69.8 to 83.2 cents per hour. The next seven days show a less exact progression but still a marked iprovement. The next 23 days show little change although the normal fluctuation in crew earnings is evident. Earnings are at 87 cents per hour on the average for this period. During the last 36 days the workers achieved an average of 98.4 cents per hour. These last two trend lines look much like plateaus of learning.

The average earnings of 98.4 cents over the last 36 days were higher than the county-wide average earnings for 1954–55 (see figure 14). The fact that it was attained by these workers within 34 work days since they started indicates an unusual speed in learning.

Table 11 presents frequency distributions of the earnings of these 55 workers on the first day they worked, the first eight days they worked, and the last eight days

Table 11. Distribution in earnings per hour of beginning workers assigned successively to House C, during first day, doing first eight days, and during last eight days of first 70 days of employment, 1954–55, with descriptive measures.

Class intervals by 3 cents	First day	First 8 days	Last 8 days
cents	*number of workers*		
133	1		
130			1
127			
124	1		
121			3
118			2
115			2
112	1	1 (1)†	2
109	1		9 (1)
106			3
103	1	2	4 (1)
100	1	1 (1)	6 (2)
97	2	3 (2)	4 (2)
94	3	4 (2)	1 (1)
91	1	4 (1)	5 (1,
88	4	7	2 (1)
85	2	2	2
82	1	6 (2)	3
79	3	3	3 (1)
76		4 (1)	1
73	4	3	
70	2	2	1
67	2	3 (1)	
64	3	2	
61	1	3	1 (1)
58	3	3	
55	2		
52	2		
49	2		
46	2	1	
43	2	1	
40	2		
37	2		
34	2		
31	1		
28			
25			
22			
19			
16	1		
Total	55	55	55
M	70¢	80¢	99.4¢
σ	±24.9¢	±14.55¢	±14.13¢
σ_m	± 3.38¢	± 1.98	± 1.92¢
	:	::	:
		.....	.....
σ_{m-m}		±3.91¢	±2.76¢
Number of σ_{m-m} between means		2.56	7

† Bracketed figures refer to the study discussed on this and the next page.

of the 70-day period studied. Between the first eight days and the last eight days there is a difference in average earnings of 19.4 cents, a difference which table 11 indicates is significant; it would not happen as a matter of chance. Between the first day and the first eight days there is a difference in average earnings of 10 cents, a difference which the table indicates probably would not have been caused by chance. Since the first day is a part of the first eight days, it seems likely that something besides chance played a part, namely learning. This view is supported by the steep trend lines shown in figure 16 for these first few days.

Eleven of these men were selected who together had an average of earnings their first eight days virtually equal to that of their last eight days. The range was from a gain of 8 cents an hour to a loss of 5 cents. The earnings positions of these particular workers are shown in table 11 by numbers in brackets, alongside the frequency distribution of the first eight days and of the last eight days. These 11 men did not change in the general level of their earnings even though the crew as a whole increased their earnings materially. (These are the 11 men used in the discussion on Earnings Stabilization.) A number of others improved very little, in fact, 15 of the 55 men earned 90 cents an hour or more during their first eight days.

It is evident that some of the crew were experienced pickers. They not only were able to pick fast from the start but were doubtlessly of great help in teaching the real beginners. Such a group has not been uncommon with the bracero program. Many of them return from Mexico for another contract period but for various

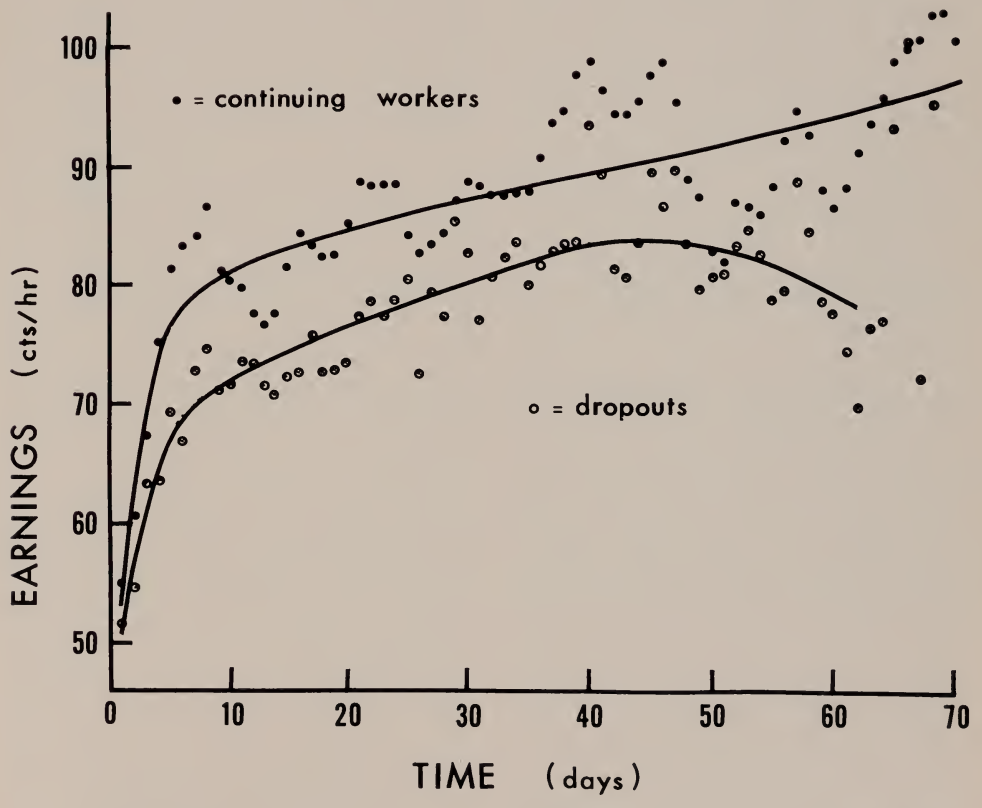


Fig. 17. Average earnings each day for beginning pickers, House I, from first day of work through maximum of 70th day of work by groupings of 46 "continuing" workers who continued through 70th day and of 50 "dropout" workers who did not complete 70 days of work, each group shown with trend lines.

reasons the fact of their being experienced is not learned until they actually start picking.

Figure 17 presents data of similar nature but from another packing house, House I. Here, 50 of the 96 workers became dropouts before they had completed 70 days of work. Whether these workers left of their own volition or management wanted to be rid of them is unknown. At this time of year, late winter and spring, it is doubtful if management released them because of lack of work; therefore most of the dropouts left because of inadequate earnings (from the worker's viewpoint) or poor work and lack of energy (from the standpoint of the employer). Either reason applies equally well as justification for the description, dropouts.

The two groups were plotted separately as shown in figure 17. Each dot or circle represents the average earning of its group on that day. The averages for the continuing workers are all of 46 workers. The averages for the dropouts, however, are for a diminishing number. Originally 50, there were 49 on the 20th day, 41 on the 40th day, 35 on the 50th, 20 on the 60th, 4 on the 63rd, 1 on the 67th, and none on the 69th day. At the end, the averages for dropouts were dominated by the vagaries of individuals, so little weight can be given that average beyond the 60th day.

In the first eight days of picking, the dropouts earned an average of 64 cents an hour while the continuing workers averaged 74 cents. Forty per cent of the dropouts earned less than 60 cents an hour during their first eight days but only 17 per cent of the continuing workers did so poorly. In contrast to the 15 of 55 workers at House C who earned 90 cents or more during their first eight days, at House I only 9 of the 46 continuing workers and only 1 of the 50 dropouts did so well.

The statistical contrast in earnings during the first eight days of the continuing workers and of the dropouts at House I can be further developed as follows:

	Continuing workers	*Dropouts*
M (cts/hr)	74.3¢	64.5¢
σ_m	2.94	1.79

$\sigma_{m-m} = 3.44$

The number of standard error differences (σ_{m-m}) between their means of the continuing workers and the dropouts is 2.85, a statistically significant number. The dropouts clearly are slower pickers than the continuing workers. This fact must go far to explain their being dropouts.

Except at the end for the dropouts, both groups in House I (figure 17) show a steady progression in earnings. The trend lines indicate clearly that a period of two calendar months may well be regarded as necessary for training. This observation may seem to conflict with our finding as to the workers for House C shown in figure 16 who did not seem to require such a long period; only 34 days were passed before the high plateau of 98.4 cents was reached. However, this group's record was clearly influenced by a high proportion of experienced workers.

Figure 14, on rising wage levels, presents some further pertinent data on the importance of experience. The crosses in that figure represent payrolls in which new men were added. The crosses occur in the low part of the annual cycle in earnings. When new men are being added, average earnings drop off. It is also pertinent to note what happened during the summer of 1963. A new rate of pay structure was in use with an intended level of earnings of $1.25. Earnings were expected to be materially above those in the summer of 1962. Nevertheless, earnings rose to only about $1.20. The reason doubtlessly lies in the continual and large-scale hiring of new braceros throughout the summer of 1963. After April 6 the number varied from 25 to 163 per two-week payroll period.

The sag in earnings during the winter months clearly is peculiar. The correlation between the use of inexperienced pickers and the lower earnings was highly pertinent but was the sag caused by lack of experience? Would the earnings of experienced pickers also decline in winter? A search was therefore made for pickers who had some experience during the winter sag period. Figure 18 shows the data on all the pickers found. There were not many; most had been repatriated.

Group I was made up of pickers from 7 different houses and including in most periods more than 60 men. From this group

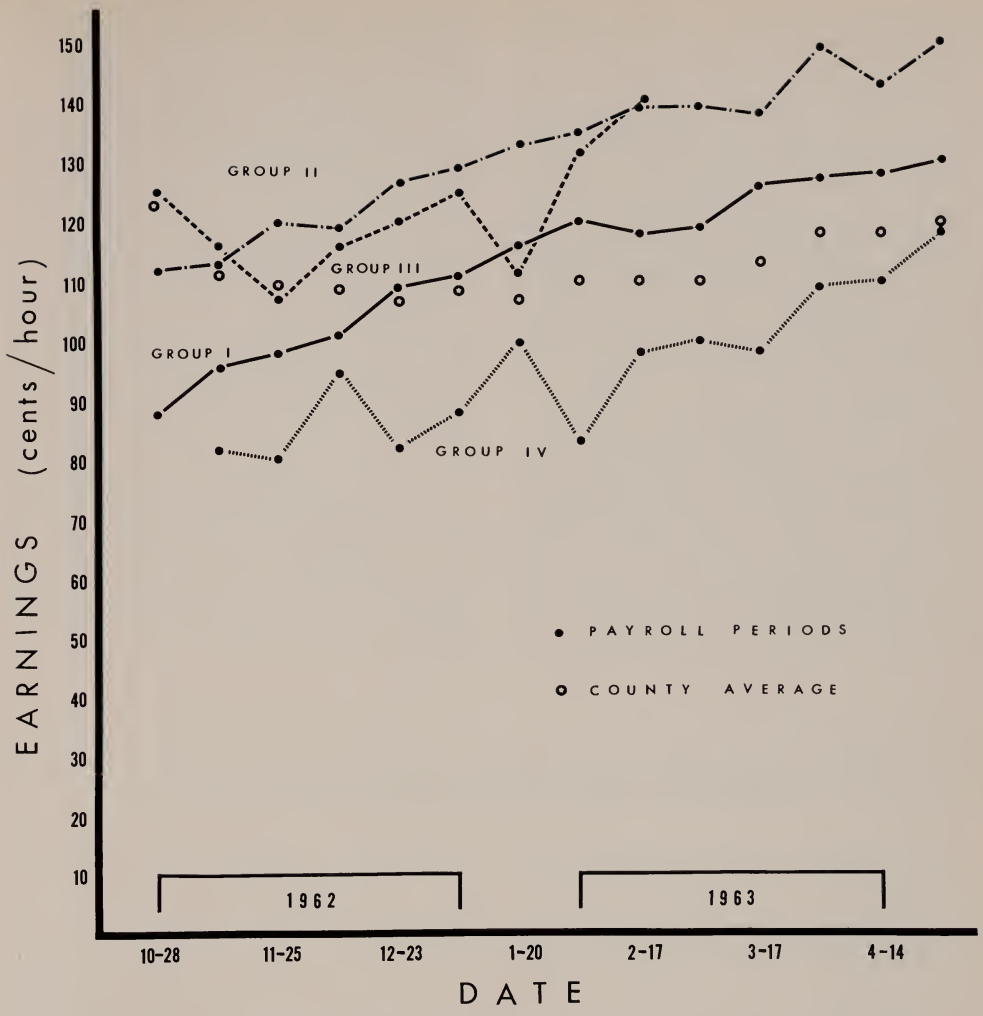


Fig. 18. Average earnings of groups of braceros contracted for picking lemons before or at start of normal winter sag in earnings, by payroll periods, 1962–63. For description of groups see text.

11 men were chosen as Group II; they each earned at least $1.00 an hour in each of their first two payroll periods. Whether they had had some earlier experience we do not know but their earnings record shows that they were relatively faster. Group III consisted of 9 men, from one house, who had been employed in July, 1962, and repatriated in March, 1963. Group IV of 14 men were from another house. These last two groups were kept separate because their earnings experience differed to some degree from the others.

All groups show a remarkably strong tendency to increase their earnings throughout this entire period. Group I of more than 60 men increased earnings in their fifth payroll period by 25 per cent over that of their first period. The same group showed an increase at the last of 14 payroll periods of another 20 per cent over that of the fifth period. The over-all increase for the 14 payroll periods was 50 per cent. The other classifications show a similar change although Group III and Group IV were somewhat erratic. Under the tree production wage system the earnings change must reflect the rate of pick; the data therefore, shows their progressive improvement in capability. It is particularly noteworthy

that this improvement is shown carrying through a total of 14 payroll periods or at least 140 working days.

A second item to note about these workers picture in figure 18 is that their earnings did not sag during the winter. Figure 18 also indicates the county-wide average earnings of all braceros. While not so great as in other years the winter sag that year was substantial. The specific workers whose individual records were traced through this winter did not have any such sag. In fact their records showed a steady improvement.

This examination of the learning period has given no attention to quality of work either in terms of care used in clipping and handling the fruit or in the selection of the fruit and the complete cleaning from the tree of fruit which is ready for picking. Most of the time, lemon picking is selective for size or color. These aspects are not easy to learn, and even experienced pickers will make mistakes which may have a material effect on the quantity and quality of fruit picked.

Neither has attention been given to the ease with which the picker did his work. Good work methods will do much to ease the required effort and to increase the picking rate that is possible. A field study of such factors, however, would have gone far beyond the scope of this project.

Training of new workers is expensive. Commonly, beginners are guaranteed a minimum earning for a period of time. Extra supervision and special teachers are required. The slower picking rate means that more pickers are required, with all the attendant costs. A poorer quality of work is done. Recently it has been common to contract braceros for only six weeks at a time which is not long enough for the men to learn how to pick. The increased cost due to the use of these inexperienced men must be substantial.

IMPACT OF MINIMUM WAGES

Since March, 1962, employers of Mexican braceros have been required to pay a minimum wage (U. S. Dept. of Labor, 1962). In California this minimum is $1.00 an hour and is applied to each day's work. The desirability of any specific level of earnings is not a topic within this report but the impact of the minimum wage requirement on the wage system and the resulting efficiency of operations is highly pertinent.

As has been stated, rates of work among individuals vary widely and efficiency and equity require that these differences be maintained. Also, successive orchards and orchard picks vary widely in the rate of pick which any given individual can achieve in them. The tree production wage system modifies these differences among orchards and orchard picks in their impact on the earnings of individuals. Each individual is kept under the pressure of an incentive wage system but his earnings from day to day are stabilized significantly as far as orchard differences are concerned. The differences among workers are maintained, however, and to an important degree are stabilized from day to day, season to season.

The influence of a minimum wage depends on how close the minimum wage is to the particular earnings of a particular individual under the incentive system. If, for instance, an individual's earnings under the incentive system are $0.85 an hour but the minimum is $1.00, the time keeper is forced to pay $1.00 an hour and the incentive to pick fast is quickly destroyed. The effect is the same as that of the guarantee in use in 1944. The rate of pick can be expected to fall off materially.

If the minimum equals the earnings of any of the workers, they will slow down; it is difficult to justify their doing otherwise. Moreover, those who earn just a little more under incentives than under the minimum will see little reason for their greater exertion, they too will slow down, even though their earnings drop a little. The influence of the minimum wage thus

tends to be progressive from picker to picker up the incentive levels of earnings.

At what position can a minimum wage requirement be relative to the successive earnings levels under incentive rates and still not have a detrimental effect on the crew's rates of work? The answer lies in the distribution of rates of work within a crew, the variations in the rates of work among crews, the variations in successive orchard picks, and the variations in picking policy among the various houses. In the analysis of this problem, use will be made of the mean, M, and the standard deviation, σ, as being recognized and stable descriptive measures of data that are ranked.

Introductory "Example" Crew

To introduce our discussion, we will use the data (table 6) of an actual crew on one specific day in one specific orchard. The distribution of the crew as to rates of work was normal. This crew is described in table 6 both in terms of a frequency distribution of the actual members and in terms of the resulting M and σ values. Reference will be made to the actual frequency distribution but primary use will be made of the M and σ values.

In table 12 we apply these M and σ values to the problem of the minimum $1.00 an hour wage. We do this by hypothetically placing the $1.00 minimum at four different levels or positions, that is, at M, at -1σ, at -2σ, and at -3σ. Each analysis is in a column headed by the sign at the level of which is placed the minimum wage earnings. All four analyses are placed in vertical scale according to the earnings scale on the left side of table 12.

If we apply the $1.00 minimum to this particular crew at the -3σ level, we note that the -3σ position is far below the position of the slowest worker (see table 6). We also note that the rate of work of this crew on this particular orchard day at the

Table 12. Hypothetical earnings of example crew distributed among crew on basis of M and σ values of actual rates of pick with earnings level set at M = $1.00/hour, at -1σ = $1.00/hour, at -2σ = $1.00/hour, and at -3σ = $1.00/hour, May 1962 data.

	Earnings when minimum wage is positioned at:			
	M	-1σ	-2σ	-3σ
Rate of pay (cts/bx).....	38.9¢	45.9¢	55.8¢	71.3¢
σ values with σ=0.389 bxs/hr	15.1¢	17.9¢	21.7¢	27.7¢
Earnings scale				
$2.70				$+3\sigma$ = $2.66
2.50				$+2\sigma$ = 2.39
2.00			$+3\sigma$ = $2.09	$+1\sigma$ = 2.11
			$+2\sigma$ = 1.87	M = 1.83
		$+3\sigma$ = $1.72	$+1\sigma$ = 1.65	
1.50		$+2\sigma$ = 1.54		-1σ = 1.55
	$+3\sigma$ = $1.45	$+1\sigma$ = 1.36	M = 1.43	
	$+2\sigma$ = 1.30			-2σ = 1.28
	$+1\sigma$ = 1.15	M = 1.18	-1σ = 1.22	
1.00	M = 1.00	-1σ = 1.00	-2σ = 1.00	-3σ = 1.00
	-1σ = 0.85	-2σ = 0.82	-3σ = 0.78	
	-2σ = 0.70	-3σ = 0.64		
0.50	-3σ = 0.55			
0.00				

-3σ level is -1.403 boxes per hour. The $1.00 an hour minimum amounts to a payment of $1.00 for 1.403 boxes of fruit or a rate of $0.713 per box. This box rate of pay at $0.713 per box must be paid if the incentive rate of pay is to equal $1.00 an hour at this -3σ level. If this same rate of pay per box ($0.713) is applied to the M value of this crew on this day and to its other σ values, the earnings per hour are as follows:

$+2\sigma = 3.35$ bx/hr = $2.39/hr
$+1\sigma = 2.96$ bx/hr = $2.11/hr
M = 2.57 bx/hr = $1.83/hr
$-1\sigma = 2.18$ bx/hr = $1.55/hr
$-2\sigma = 1.79$ bx/hr = $1.28/hr
$-3\sigma = 1.40$ bx/hr = $1.00/hr

These M and σ values in terms of their respective earnings are found at their scale level in table 12 in the column headed by the -3σ sign. Obviously this crew in this situation would give no attention to the minimum wage. The slowest actual picker in this particular crew on this particular day picked at a rate of 1.75 boxes per hour. His incentive earnings at $1.25 an hour are enough higher than $1.00 to rule out the $1.00 an hour as an acceptable alternative.

If the $1.00 minimum is equal to a position 2σ below the M, a worker at that 2σ point picks 1.792 boxes per hour and must be paid 55.8¢ a box to earn $1.00 an hour. The mean earnings of the crew are then $1.43 an hour and earnings at 2σ above M are $1.87 an hour. In this situation, the slowest worker will have his earnings affected slightly by the minimum. Two or three others are so close to the minimum they may be tempted to slow down in their work and take the minimum wage. In this situation this small group of slowest workers, if they purposely slow down, will probably become a distinct discrete grouping and become easily identified. They will therefore not be a particularly serious problem to management. Supervisorial pressure can probably be used to maintain them at a reasonable rate of work.

If the $1.00 an hour minimum is equal to a position 1σ below the M, a worker at that 1σ point picks 2.181 boxes an hour and must be paid 45.9¢ a box to earn $1.00 an hour. The mean earnings of the crew are then $1.18 an hour and earnings 2σ above M are $1.54 an hour. In this situation, six workers will have their pay increased by the minimum wage, the slowest by an additional 25 per cent. At least four others will wonder if their earnings over the minimum are worth the effort. We do not know how far into the faster pickers the minimum wage would extend its influence but it would certainly be close to the M. Costs to management will increase both because of the effect of the minimum wage on the earnings of the slowest pickers and because of the slowdown in work which will inevitably result in this whole group. To avoid this increase in costs, management will try to use only those workers who work fast enough not to be influenced by the minimum rate of pay. It is very likely that the slowest pickers will not have employment in this situation.

If the one dollar an hour minimum wage is equal to M, the situation is so serious as to be hopeless. Almost all workers will ignore the incentive and depend on the minimum wage.

What we have emphasized with this example crew by use of the various σ positions is that the influence of a minimum wage depends largely on its level relative to the level of earnings received under the incentive rates.

The Total Complex of Variables

The effect of the minimum wage on the situation is more complex, however, than has been shown thus far. The example dealt only with the problems of one specific crew as it picked in one specific orchard on one specific day. Crews differ widely; some are fast and some are slow. Orchards differ widely and the differences are magnified by the day, the season, and the year. Packing houses differ in their practices and standards. The effect of these differences is shown in table 7 where the example has a σ value of only $\pm$ 0.389 boxes per hour but the simple or total over-all deviations have a σ value of $\pm$ 0.835 boxes per hour. The σ_3 deviations of $\pm$ 0.835 boxes per hour are believed to approximate the situation of all crews in all orchards and all orchard picks in the county.

Table 13 shows three distributions or

Table 13. Hypothetical earnings of workers distributed on basis of M and σ values of rates of pick established for average crew with simple overall deviations, with earnings level set at M = \$1.25/hour, at -1σ = \$1.00/hour, and at -2σ = \$1.00/hour, May, 1962 data.

	General level of earnings (assumed)		
	M = \$1.25/hr	-1σ = \$1.00/hr	-2σ = \$1.00/hr
Rate of pay (cts/bx)	35.8 ¢	37.7 ¢	54.9 ¢
σ values with σ =0.835 bxs/hr	29.9 ¢	31.48¢	45.8 ¢
Earnings scale *cts/hr*	*cts/hr*	*cts/hr*	*cts/hr*
\$2.80			$+2\sigma$ = \$2.83
2.50			$+1\sigma$ = 2.37
2.00	$+2\sigma$ = \$1.85	$+2\sigma$ = \$1.94	M = 1.92
1.50	$+1\sigma$ = 1.55	$+1\sigma$ = 1.63	-1σ = 1.46
	M = 1.25	M = 1.31	
1.00	-1σ = 0.95	-1σ = 1.00	-2σ = 1.00
	-2σ = 0.65	-2σ = 0.69	
0.50	-3σ = 0.35	-3σ = 0.37	-3σ = 0.54
0.00			

earnings with the simple over-all deviation of $\pm$0.835 boxes per hour. One column places the mean earnings, M, at \$1.25 per hour, just then the intended level of earnings in the county. The second column places the \$1.00 minimum wage equal to the -1σ level of 2.655 boxes per hour. The third column places the \$1.00 minimum wage equal to the -2σ level or 1.820 boxes per hour. All M and σ values are ranged vertically according to the earnings scale on the left side of table 13. The \$1.25 level controls the first column, the \$1.00 minimum controls the level of the other two.

M = \$1.25. If M = \$1.25, the range of incentive earnings by experienced workers is from near \$0.65 at -2σ to near \$1.85 at $+2\sigma$. The \$1.00 minimum is above the -1σ value of \$0.95. This situation approximates the actual situation in Ventura County in 1963. Theoretically about 20 per cent of the experienced pickers in the county will earn less than \$1.00 under the incentive rates (Hirsch, 1957). The temptation for these 20 per cent is great to disregard the incentive rates. They cannot be expected to exert themselves. Similarly, management will be tempted to return these workers to Mexico. It is virtually inevitable that 20 per cent of the braceros will thus become dropouts.

The above percentages are of experienced workers. Most inexperienced workers would be below the \$1.00 minimum initially and many would be below it for two months. They have no incentive to exert themselves.

Actual dropouts. Between May 2 and June 13, 1963, the number of braceros employed in Ventura County citrus increased by 1,202—from 1,946 to 3,148. The increase in oranges was from zero to 815, in lemons from 1,946 to 2,333. The new contract workers brought in during this period, however, numbered 1,906, an excess of 704 over the increase in numbers. A

total of 689 were repatriated, most of whom can be classified as dropouts, either because they were discouraged at their own rate of work or their employer did not want them because of their low rate of work.

With the 1,946 on hand by May 2, and the 1,906 new contract workers, a total of 3,852 men were employed. The number repatriated, 689, is 18 per cent of the total, not too far off from our theoretical figure of 20 per cent. (The 18 per cent figure of repatriated braceros is not applicable to the May 2–June 13 period alone. It is part of a several-month period.)

Most braceros were contracted for six-week periods and the slow ones usually were not rehired. After only six weeks, many were still inexperienced. Their earning experience could be compared with those of the dropouts from House I (pages 43, 44). An incentive pay scale is therefore particularly important in the training period because fruit picking is hard work and requires strong motivation. Under the circumstances of the study these dropouts did not have a good chance to succeed.

-1σ = $1.00. If -1σ = $1.00, M brings in $1.32 per hour and $+2\sigma$ brings in $1.95. There would be no effective incentive wage below -1σ. This would include about 16 per cent of the county braceros.

-2 = $1.00. If -2σ = $1.00, -1σ brings in $1.64 per hour, M brings in $1.92 per hour, and $+2\sigma$ brings in $2.84. There would be no incentive wage below -2σ but it would include only about 2 per cent of the experienced braceros. The proportion is so small that it would cause little or no difficulty.

An Incentive for the Inexperienced

To assure the provision of an incentive for inexperienced workers, the $1.00 an hour minimum wage would have to be applied at the -3σ level. To do this with the situation described in table 13 would raise M wages to $3.55 and the $+2\sigma$ wages to $5.25. It did not seem practical to include a schedule of this sort in table 13.

The incentive rates are an aid in teaching workers how to work fast within a short period of time. The situation as it exists is discouraging for the beginners. Their wages are set by the minimum, and 20 per cent of the experienced workers are also in the same situation.

The Critical Issue

A specific conflict of circumstances exists here: On the one hand, the nature of the job, the nature of the workers, and the wage system that is necessary, require that there be a wide range of earnings. On the other hand, the minimum wage is designed to put a floor under wages. But in so doing, because of the wide range and fluctuations in earnings, the average level of earnings will be raised unexpectedly high if the incentive system is to be effective at all levels.

As matters stand now, an important proportion of workers have their wages maintained by the minimum wage at a level above that which they would otherwise receive under the incentive rates. Consequently, these people are being repatriated by their employers. In short, the result of the conflicting circumstances is that slow and inexperienced workers are not being kept on the job.

There is good reason to think that the application of the $1.00 minimum wage in March, 1962, was an important factor in the raising of the intended level of earnings in Ventura County lemon picking to $1.30. The question arises how much farther up will this level have to go if these slow and inexperienced workers are to be kept on the job.

We have already indicated that setting the -3σ level at $1.00 appears impractical. However, to say what these earnings should be would be beyond the scope of this study.

Alternatives to Management, if Management Acts Alone

If the lemon industry management has to solve the problem by itself, it can resort to four alternatives, as follows:

1. *Management can continue to return slow workers to Mexico.* It is unfortunate that these bracero dropouts cannot be given a chance to "learn the trade" and to earn more money in the United States. In any chance group of workers some are

inevitably slow; but this doesn't mean that the slow workers cannot eventually succeed. However, management has no reason to keep them with their compliance as they cost much more per box of fruit picked than the faster pickers.

2. *Management can raise wages.* The raise, however, would have to be substantial if the incentive wage system is to be effective and if the minimum wage of $1.00 per hour is to be applied. With experienced workers only, the wage levels must be such that the -2σ value is at least $1.00 an hour. When dealing with inexperienced workers, an incentive rate at the -3σ level is desirable but placing the -3σ level equal to $1.00 an hour would multiply costs, something that growers would not easily accept.

With respect to higher wages, the marketing situation of the lemon industry must be considered. The industry is not in a position to absorb a material increase in costs.

3. *Management can try to develop a less costly wage incentive system.* A less extreme raise in wages to the M and $+\sigma$ levels would occur if the incentive rates, instead of being proportional to output, were graduated. One way of describing it is to say that the gradation of earnings to output is sloped, not straight up and down. Elaborate systems of this type have long been common in urban industry but are rare in agriculture. Such systems immediately require judgments about the level at which to initiate the incentive and about the slope to use. A nonproportional rate of pay schedule would not be equitable among pickers; it might be found to be ineffective as an incentive. We recommend continuance of the present practice if at all possible.

4. *Management can develop faster methods of picking lemons.* As described under Changes in Picking Practices and Standards, lemon management has already accomplished a great deal, and more steps are ahead, some far more important than anything accomplished to date.

Conclusions As to the Use of the Minimum Wage

The minimum wage is a simple but effective means for raising wages. It may eliminate an opportunity to work for slow workers but for those who can keep working it may bring about a material increase in pay. This advantage in pay to these people constitutes its objective and its justification. On the other hand the tree production wage system in its intended level of earnings has advantages in achieving the same objectives:

- Workers are paid in proportion to output.
- No worker is prevented from learning how to pick fruit or from having a job.
- The intended level of earnings is ideally defined for determining a proper level for wages, having in mind all workers.
- Costs to growers are easily ascertained.

The tree production wage system presents only one problem. It requires a definite agreement and understanding among the responsible people involved. Such an agreement and understanding, however, has come to be a regular practice by the lemon industry of Ventura County. Its advantages justify efforts to put the system on a broader basis.

DIFFERENCES AMONG PACKING HOUSES

We have already demonstrated that the individual picker's position, as measured by the standard deviation, increases markedly as other crews and other houses are added. The standard deviation of the individual pickers within a single crew is far less than it is within a number of crews and a number of houses. The degree of difference is shown in the various definitions of standard deviation shown on page 22.

The amount of the differences among

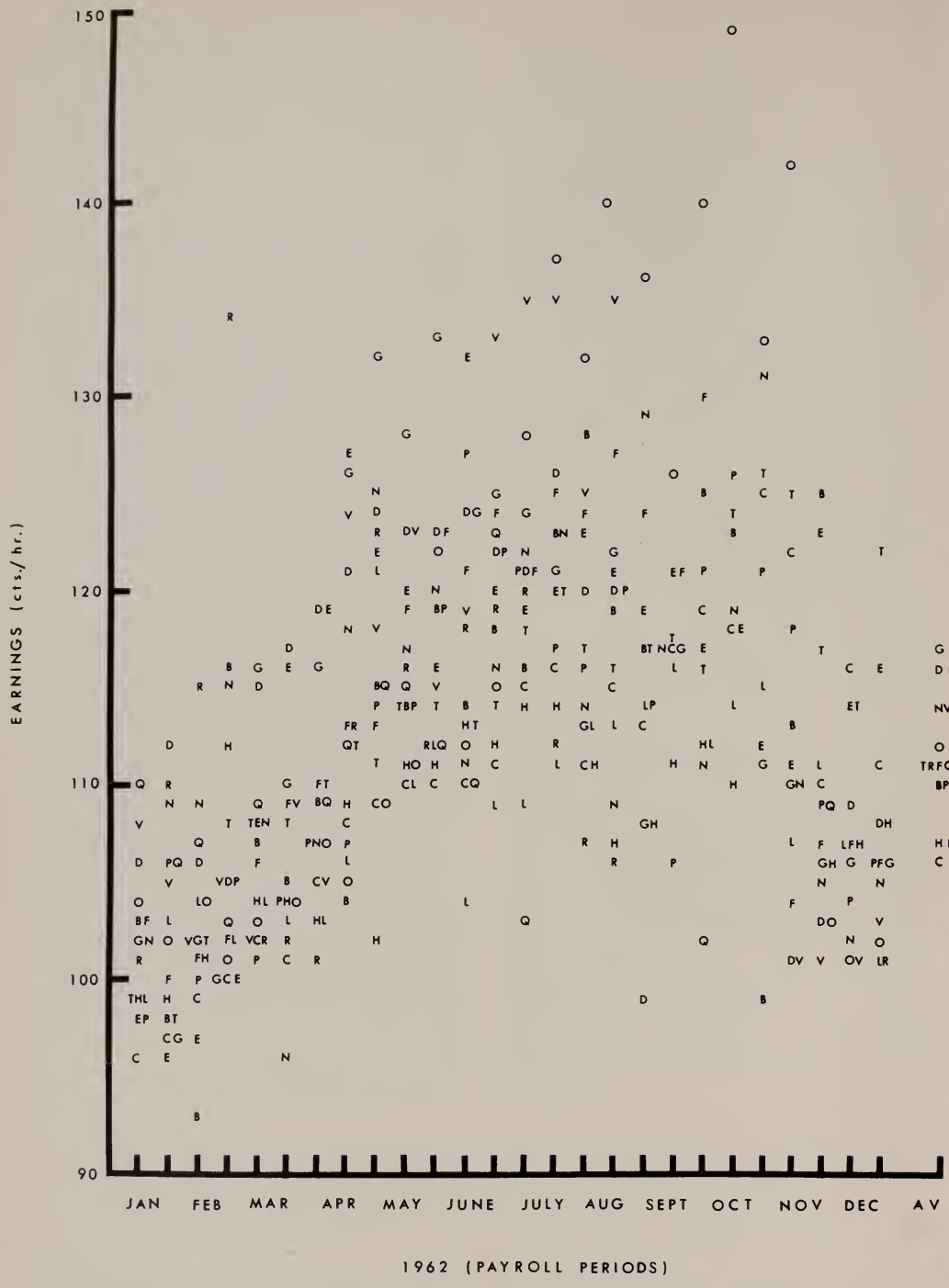


Fig. 19. Average earnings of pickers per hour by 15 individual packing houses (designated by letters) and by payroll period, 1962, with average earnings for year. The extreme earnings of certain houses in certain periods were due to special circumstances as explained in the text, page 53.

houses is shown in figure 19. This figure shows the average earnings of all braceros for each lemon packing house during 1962 by payroll period. Each house is given a letter and the vertical position of the letter in each payroll period shows the average earnings of the braceros. At the right side of the figure is shown the average earnings of each house for the entire year.

Examination of figure 19 shows a significant scatter in these earnings. The range for the year's average was from 106 cents to 117 cents. The range by payroll periods was far greater. During the summer months, the average earnings were not only much higher but also the scatter or range was far greater than in the winter. By tracing through, from payroll period to payroll period, the experience of each house, it becomes clear that different houses had different earnings. These differences existed although all, presumably, were using the same wage schedule.

Earnings by certain houses in certain payroll periods were exceptionally high. These cases were all due to special circumstances which for a time dominated house policy. In one situation changes were taking place in the management set-up and for a time no fruit was picked. When the new management took over, the trees were overloaded with fruit and had to be picked immediately. In the emergency, standards were relaxed and practices were followed which would speed up the pick and result in higher earnings per hour. In another case the high earning was that of one small crew, picking for a relatively few days; chance could easily have brought about the exceptionally high earnings shown.

Using this data for all houses for the previously reported period in May, 1962, and separating out the deviation due to crew differences, a standard deviation among pickers due to house differences was found of ±6.28 cents. These house differences we ascribe to differences in policies and practices on which we have no specific information. In certain situations differences in orchards might explain them but in other situations the orchards were not significantly different. It is probable that differences in box fill, in use of ring, in requirements as to color, in use of the single clip, and in general handling practices, could explain some differences in earnings. Basic differences in management attitudes no doubt play a part but we have not been able to pinpoint any such specific differences.

Figure 19 shows that in January the range of differences among the houses was far less than in the summer. The differences then appear to be dominated by the differences among crews. The standard deviation among crews in May we found to be ±7.74 cents as compared to ±6.28 cents among houses. In January, however, the differences among crews we found to have a standard deviation of ±13.56 cents and we could find no clear indication of differences among houses. We surmise that crews in January were dominated by the large proportion of inexperienced men, many just starting to pick. A crew of such men might spend considerable time in one orchard and the resultant statistics would tend to emphasize crew differences. Differences among houses as to their own policies and practices would tend to be subordinated in the general low earnings situation.

The May data analysis and the general picture presented by figure 19 show clearly, however, that house differences play an important part in determining what pickers may earn. Careful study by the various house managements would probably indicate something as to the policies and practices responsible, following which a more uniform earning level might be achieved throughout the country.

COSTS

Lemon picking costs to the grower are made up of one major figure: his labor wage cost per box of fruit. Behind this charge lie certain costs commonly called overhead which are very closely related to the labor costs.

Measurement of Direct Labor Cost Changes

This report has given examples of significant cost changes:

1. Picker earnings have risen over the past 20 years. In 1943, the usual wage rate was 28 cents an hour plus some box rate such as 14 cents. No record exists of the level of earnings during that period but apparently earnings varied from well below 50 cents to more than 80 cents an hour. Today, the intended level of earnings for the average experienced picker is around $1.30 an hour. Figure 14 presents the picture of part of this rise in earnings. Growers' picker wage costs have increased but, because of higher rates of pick, not as much as picker earnings.

2. In 1944–45, the substitution of the tree production incentive wage system for the guarantee resulted in a marked increase in rate of pick, estimated for some houses at 40 per cent. Earnings were raised from the guarantee of 65 cents an hour to an earnings level near 75 cents. Costs were lowered substantially because of faster picking. Our estimate is that with the substitution of an incentive system for the guarantee in 1944–45 the rate of pick was increased 40 per cent. This change lowered the number of men needed by 29 per cent. On the other hand, if workers shifted from an incentive to an hourly rate, a proportionate slowdown to a rate of pick 29 per cent slower could be expected and one could expect an increase in number of men needed of 40 per cent.

3. Over the past several years, the industry has been changing its picking practices and standards, bringing about a material increase in rate of pick. The faster picking practices did not lower costs per box directly but indirectly benefited the grower by raising wages at no cost to him.

4. A longer interval between picks has been adopted. Under the tree production system there was no change in earnings but there was a significant lowering of cost to the growers. Fewer picks result in higher yields per pick and the higher yields are picked at a lower cost per box.

The new practices described under 3 and 4 lowered the number of men needed in reverse ratio to the changes in rate of pick. An increase in the rate of pick since 1947 of 24 per cent has been indicated (page 36). Such an increase would lower the number of men needed by 19 per cent. That is, 81 men who increased their rate of pick by 24 per cent would do as much as 100 men at the old rate of pick. The 24 per cent increase in rate of pick can also be thought of as a substitute for a 24 per cent raise in rate of pay per box simply because wage levels were rising and the grower otherwise would have had to pay this specific increase out of his pocket.

Overhead Costs

The following items usually are included in overhead costs:

- Supervision and a portion of central management
- Retirement plans for permanent employees
- Labor camp expense including depreciation
- Garage expense including depreciation
- Auto and bus expense including depreciation
- Field boxes, ladders, bags, clippers, etc., including depreciation
- Supplies and repair
- Wet time and guaranteed wages
- Rainy day board
- Ventura County Citrus Growers Committee expense
- Growers association expense
- Insurance

Table 14. Costs per field box of picking lemons, total, direct labor, and overhead, five houses, Ventura County, 1961–62.

Association	Total*	Direct labor†	Overhead	
	cents	*cents*	*cents*	*per cent*
(1)	43.5	32.1	11.4	26.2
(2)	46.6	32.2	14.4	30.9
(3)	43.9	32.8	11.1	25.3
(4)	40.7	31.9	8.8	21.6
(5)	44.3	32.6	12.0	27.1
Weighted average	44.0	32.3	11.7	26.6

* Individual house records.
† Ventura County Citrus Growers Committee records.

Table 14 shows the importance of overhead in relation to direct labor costs. (Certain nonpicking cost items have been left in but they were nominal in amount and difficult to segregate out.) The table shows that overhead, on the average, costs 11.7 cents per field box, and that this amounted to 26.6 per cent of all picking costs.

The items included in picking overhead are influenced to a great extent, at least in the long run, by the number of pickers required. The size of the labor camp, the number of buses required, the number of supervisors needed, wet time, rainy day board, and all the associated items of depreciation and insurance must be very closely related to number of men working at peak requirement times. Since an increase in the rate of pick automatically reduces the number of pickers required, an increase in the rate of pick will lower overhead costs in the long run. The prime attention given to labor costs, both direct and overhead, should be directed at the rate of pick.

The relationship of overhead to number of men required is influenced greatly by the peak number of men needed, no matter for how short a time. This peak number determines the size of the camp, the number of trucks needed, the number of ladders needed, etc. Their rate of depreciation may be lowered if their use each year is shortened, but not necessarily so and not greatly.

Any rise in overhead costs, because of more men being needed, will be immediate and specific. The investment in camps, trucks, and organization must be made if the additional men are to be used. On the other hand, a drop in costs will be slow to develop. The investment in camps, trucks, and organization is a sunk investment and seldom can be recovered.

The Analysis of Picking Costs

The number of men needed is a very important factor in both direct labor costs and in overhead costs. The number of men needed depends almost entirely on the rate of pick. Control of peak requirements is a factor but that only implies a redistribution of man hours of work. The first and only essential element in the analysis of picking costs is the rate of pick. This fact justifies the detailed attention we have given to the incentive wage system. Without a satisfactory incentive wage there is no promise of maintaining a proper rate of pick.

The specific payment to labor is determined by two basic variables: rate of pick, and level of earnings. The rate of pay per box, while it looms large in an accounting sense, is essentially incidental to the rate of pick and the level of earnings, and is determined by their relationship. A large tree with a low yield and small-sized fruit is expensive to pick, not because the rate of pay is high, but because the rate of pick is low. A two-dollar-an-hour man is more expensive than a one-dollar-an-hour man, not because he insists on a higher rate of pay per box but because he insists on a higher level of earnings; a faster or slower rate of pick can change the charge per box but he will still want his two dollars. Thus the fundamental influences on the payment to the picker are rate of pick and level of earnings. Any significant lowering of costs to growers will be achieved either by increasing the rate of pick or by lowering the level of earnings.

Level of Earnings

This study deals largely with the rate of pick as it is related to the wage system. Some attention needs to be given, however, to the level of earnings, even though our function is not to attempt any determination of what that level should be. Our

responsibility here is more limited and can be said to be the description of the considerations which must be kept in mind when the level of earnings is determined.

In the past, the dominating circumstance as to wage levels for seasonal labor in California agriculture has been the use of indigent labor. By and large this labor had no other opportunities for work and, being in large supply, it had to work for very low wages. It has been made up of various races, the most common of which was Mexican. In the past, this group did little other than farm hand labor tasks.

Since World War II most locally resident Mexicans and other United States citizens have left lemon picking, attracted to other opportunities by higher levels of earnings, more continuous employment, and better working conditions. Much of the picking has been done by contract Mexican nationals. Now, however, influential government factors are insisting that the contract program be brought to a close. To date a renewal of the program has been rejected by Congress. Also strong forces are insisting on a higher level of pay, as evidenced by the imposition of the minimum wage level for the contract Mexican nationals. It appears therefore likely that the lemon industry will have to go into the labor market and compete for labor which can no longer be considered indigent.

The currently rising level of wages may well accelerate. In such a situation, it is important for the industry to have a good system for paying pickers. Otherwise, packing houses, in their anxiety to get their fruit picked, are likely to compete in their rates of pay or to abandon standards of quality work which over the years have proven advantageous. Newcomers, well acquainted with the methods of pay and supervision in other industries, will be skeptical of the type of incentive pay and the supervision used in the citrus industry. Unless systems for paying pickers are applied in a clearly equitable fashion, these newcomers may object to them, and costs might rise far more rapidly than before.

The level of earnings is subject to many different influences. Normally it has been an amount acceptable to both employer and employee and in that sense a product of bargaining, although there has been very little labor-management "bargaining" in the lemon industry. In recent years the United States government and Mexican consuls have represented the contract braceros and in that sense there has been bargaining. The phrase "going rate of pay" has been used commonly in discussing the intended level of earnings but the reference has been historical. Influence is exerted by the community at large which is taking an increasingly larger interest in these matters. Management must fit itself into the general community situation. The individual management, for instance, can do nothing to influence the level of earnings already being paid to potential employees whom the lemon people are proposing to hire.

Another basic factor is that the level of earnings must be materially higher under an incentive rate than under an hourly rate. "The problem may be stated (Smith, 1947) as one of dividing the savings made in cost (from adoption of an incentive system) between employer and employee. These savings in costs are of two parts, one being the saving in labor time cost, the other being the saving in overhead. There is a reduction in labor time required because an incentive system promotes faster work. There is a saving in overhead because the saving in time permits more efficient utilization of equipment, supervision, and similar cost factors. In either case, the employer's gain appears as a lower cost, the employee's gain appears as higher earnings per hour.

"If total hourly earnings under incentives are the same as under a purely time rate, it is apparent that the employer not only has obtained the savings in overhead, but also has absorbed the entire reduction in labor time cost. If earnings per hour have increased more than proportionately to the rate of work, the employees have received not only the reduction in labor time cost, but also some or all of the saving in overhead. Usually the two parties share in the saving effected. The suggestion made here is that the apportionment of these savings must be worked out with fairness to both parties.

"In fact, a fair and generally accepted division of the savings in time costs may

be regarded as an absolute necessity in a satisfactory incentive system. Both employer and employees share in responsibility for the reduction in costs and both should share in the advantages. The employer has contributed management and investment, the laborer greater effort. Unless both are satisfied, the incentive system cannot be regarded as well established."

In a general sense, there are two approaches to a study of the relationship between incentive pay and hourly pay. One is by difference in rate of pick. The other is by analysis of the level of earnings necessary to attract labor away from jobs paying by the hour.

We have provided only one indication of how much faster lemon pickers work under an incentive than under an hourly rate (page 20). In that instance we estimated a 40 per cent increase in rate of pick. A similar increase in earnings is certainly something the workers would expect.

Such a relationship in pay for his specific labor would still leave the employer with a material gain in his overhead costs. If one accepts the relationship between overhead and number of pickers as being proportional, the overhead costs of today without an incentive system would be 16.4 cents per box instead of the actual 11.7 cents.[7]

The level of earnings necessary to attract labor away from jobs paying by the hour may be indicated by considering the relationship between the average level of earnings under incentive pay and a minimum wage. There we pointed out the advantage of having the average level of earnings high enough so that its -2σ would not be below the minimum. Otherwise, there would be serious prospects of the minimum wage eroding workers away from the incentive. Similarly it seems likely that if alternative jobs pay on an hourly basis a given amount, the average level of earnings under incentives should perhaps pay the same two standard deviations greater difference; otherwise pickers, certainly slow ones, will turn to the hourly pay in preference.

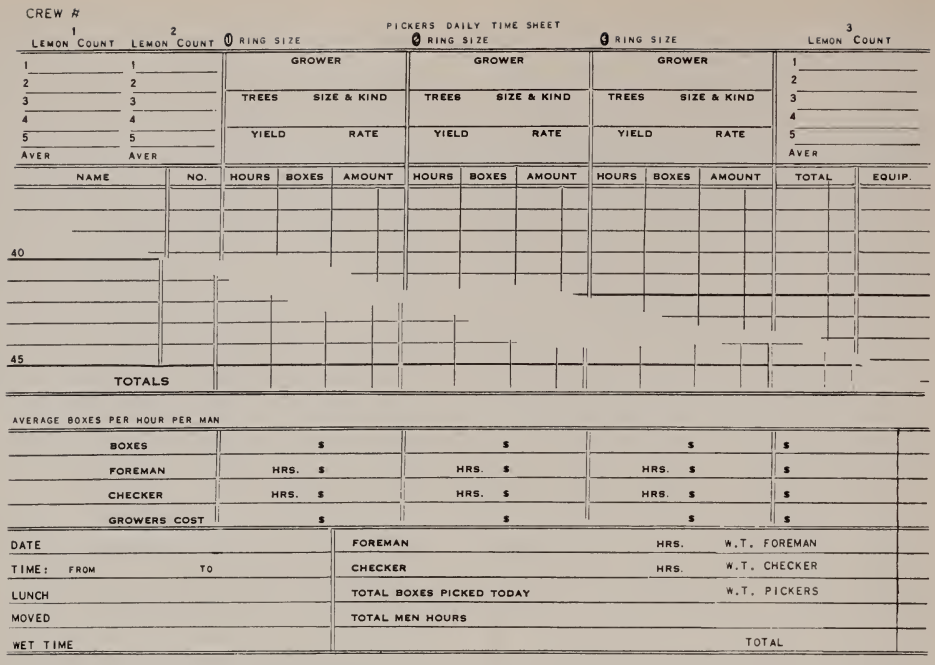
Fortunately for the employer, many of the pickers may place a greater value on extra earnings than has been indicated by this formulation. Enough of them may be willing to work at an increase in earnings less than proportionate to the increase in rate of pick. This decision is for the worker to make. In such a situation, the slow pickers are likely to leave but the rest would stay on. Even if certain average and fast pickers left, many might value the extra earnings enough to stay on. Those staying might or might not do poorer work and thus lower the advantage to growers of incentive returns being at a somewhat lower level. Empirical data are needed for further study of this problem.

ACCOUNTING PROCEDURE

The tree production wage system required some changes in the accounting procedures used by the packing houses. The new procedures, however, actually reduced the work required as compared with the old method. Primarily the reduction in work was due to practices which enabled the crew foreman or office accountant to proof figures each day as soon as data was entered. In consequence, when payroll entries were finally made the entries would always be found to be accurate. For this reason the total volume of work was reduced.

Figure 20 shows a standard packing house field sheet. It provides a place for all information needed for a crew each day. A line is given to each picker beginning with his name and number which identifies the boxes of fruit he has picked. For each picker the hours spent on the job and the number of boxes picked are shown.

[7] An increase of 40 per cent in rate of pick (figure 4) is proportionate to a 29 per cent decrease in rate of pick. A 29 per cent decrease in rate of pick would require an increase of 40 per cent in number of pickers and an increase in overhead, if proportionate, to 16.4 cents per box.


CREW #

PICKERS DAILY TIME SHEET

1 LEMON COUNT | 2 LEMON COUNT | 0 RING SIZE | 8 RING SIZE | 8 RING SIZE | 3 LEMON COUNT

GROWER | GROWER | GROWER

TREES | SIZE & KIND | TREES | SIZE & KIND | TREES | SIZE & KIND

YIELD | RATE | YIELD | RATE | YIELD | RATE

1 2 3 4 5 AVER

NAME	NO.	HOURS	BOXES	AMOUNT	HOURS	BOXES	AMOUNT	HOURS	BOXES	AMOUNT	TOTAL	EQUIP.
40												
45												
TOTALS												

AVERAGE BOXES PER HOUR PER MAN

BOXES	$	$	$	$
FOREMAN	HRS. $	HRS. $	HRS. $	$
CHECKER	HRS. $	HRS. $	HRS. $	$
GROWERS COST	$	$	$	$

DATE	FOREMAN	HRS.	W.T. FOREMAN
TIME: FROM TO	CHECKER	HRS.	W.T. CHECKER
LUNCH	TOTAL BOXES PICKED TODAY		W.T. PICKERS
MOVED	TOTAL MEN HOURS		
WET TIME			TOTAL

Fig. 20. Sample showing top and bottom of field sheet used in Ventura County to keep crew records.

23¢ per box

	0	1	2	3	4	5	6	7	8	9	
0	-	.23	.46	.69	.92	1.15	1.38	1.61	1.84	2.07	0
1	2.30	2.53	2.76	2.99	3.22	3.45	3.68	3.91	4.14	4.37	1
2	4.60	4.83	5.06	5.29	5.52	5.75	5.98	6.21	6.44	6.67	2
3	6.90	7.13	7.36	7.59	7.82	8.05	8.28	8.51	8.74	8.97	3
4	9.20	9.43	9.66	9.89	10.12	10.35	10.58	10.81	11.04	11.27	4
5	11.50	11.73	11.96	12.19	12.42	12.65	12.88	13.11	13.34	13.57	5
6	13.80	14.03	14.26	14.49	14.72	14.95	15.18	15.41	15.64	15.87	6

.24¢ per box

	1	2	3	4	5	6	7	8	9	
		.48	.72	.96	1.20	1.44	1.68	1.92	2.16	0
			3.12	3.36	3.60	3.84	4.08	4.32	4.56	1
				5.76	6.00	6.24	6.48	6.72	6.96	2
					8.40	8.64	8.88	9.12	9.36	3
						11.04	11.28	11.52	11.76	4
							13.68	13.92	14.16	5
									16.56	6

Fig. 21. Table of earnings used by timekeepers in recording earnings of pickers.

Frequently, a crew will pick in two or three different orchards in one day, and each orchard may have a different pay rate. An orchard is divided into blocks, each often quite different in character. Each block is treated separately on the field sheet. For each orchard or block the number of boxes picked and the number of hours worked are recorded for each picker. Note that a separate section is provided for three different growers (or blocks). The grower's name and block number are shown at the top. For each orchard, the number of boxes picked and the number of trees from which the yield can be calculated are entered. The tree class (shown as size and kind) is entered. On either side there is space for entering sample counts of the number of fruit in five boxes and for entering their average number. From this information, tree class, yield, and fruit count, the pay rate is determined with the help of the pay schedule shown in table 1. The amount earned by each picker is calculated and entered in the field sheet.

This rate of pay is applied to the boxes by the successive pickers and the amount earned entered. A common practice in the county is to use a table of earnings as shown in figure 21. The table is set up for all the pay rates shown in table 1. The time keeper selects the section under the pay rate used. The number of boxes are listed on the left side (the tens column) and at the top (the unit column); the earnings can be read off from the intersection of the two numbers. With the pay rate at 23¢, for instance, and a picker of 47 boxes, the 4 of the 47 boxes is at the left side and the 7 is at the top. Earnings are $10.81. Earnings for each grower (or block) and for the day are totaled.

The tree production wage system was regarded with apprehension by bookkeepers when it was first introduced. It would have been arduous if the old record system had been continued. But with the bookkeeping system described above, the task became easier, and much less work was required than with the old payroll system in use with the old single rate system. The use of proved figures for every calculation made is particularly valuable in avoiding error and saving time.

An interesting practice followed by many associations is to post a copy of each completed field sheet early the following day, where the members of a crew at their leisure can examine it. Crew members thus have an opportunity to check for errors. This practice has done much to foster an understanding of the system and to win the confidence of the pickers.

In order that the information in our publications may be more intelligible it is sometimes necessary to use trade names of products or equipment rather than complicated descriptive or chemical identifications. In so doing it is unavoidable in some cases that similar products which are on the market under other trade names may not be cited. No endorsement of named products is intended nor is criticism implied of similar products which are not mentioned.

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